NURSING IN EYE, EAR, NOSE AND THROAT DISEASES

DAVIS-DOUGLAS

EYE, EAR, NOSE, AND THROAT NURSING

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PREFACE TO SECOND EDITION.

In the second edition of this little volume every chapter has been carefully revised, new matter incorporated and an entirely new chapter on Vaccine and Serum Treatment added. As stated in the first edition this book is meant simply as a guide for nurses and students in the care of the various diseases of the eye, ear, nose, and throat, and to instruct the nurse as to her exact duties during and following operations upon these organs. We trust that it may continue to be useful and a safe guide in her hands.

A. E. D.
B. D.

New York.

PREFACE TO FIRST EDITION.

WHILE this little book has been written primarily for the use of nurses, students and general practitioners will, we believe, find it of great assistance to them also. It is not a treatise in any sense of the word, but is meant simply as a guide for the intelligent care and nursing of the various diseases of the eye, ear, nose, and throat, and to instruct the nurse as to her exact duties during and following operations upon these organs.

Antisepsis and asepsis have received particular attention, since, above all, the nurse should know the all-importance of surgical cleanliness. The methods of preparing the numerous antiseptic and sterile solutions and dressings have been given in detail, while the various remedies required in the treatment and nursing of these special organs, their preparation, sterilization, and exact method of application, have been considered fully and most carefully. In fact, we have endeavored to show the nurse *how* to do things and correctly, because, in treating such delicate organs as the eye, ear, nose, and throat, the good results obtained depend fully as much upon the intelligent and painstaking care of the nurse as upon the work of the physician himself.

A brief outline of the anatomy and physiology of the eye, ear, nose, and throat has been given, in order that the nurse might better understand the subjects under consideration.

Dr. Davis has written the chapters on the eye; Dr. Douglass, those on the nose, throat, and ear.

A. E. D.
B. D.

NEW YORK.

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Eye, Ear, Nose, and Throat Nursing.

PART I.—EYE.

CHAPTER I.

THE TRAINING AND REQUIREMENTS NECESSARY FOR OPHTHALMIC NURSING; A BRIEF SKETCH OF THE ANATOMY AND PHYSIOLOGY OF THE EYE.

Necessary Requirements—Eyebrows—Eyelids—Lacrymal Apparatus—Ocular Muscles—Conjunctiva—Cornea—Sclera—Aqueous Humor—Vitreous Humor—Crystalline Lens—Uveal Tract—Choroid—Ciliary Body—Iris—Retina—Optic Nerve—Orbits—Eyeball—Accommodation—Binocular Vision.

In nursing, as in medicine, a good general training is necessary before the special branches, or "specialties," can be taken up with advantage. It seems almost unnecessary, therefore, to make the statement that a nurse in order to become proficient in nursing diseases of the eye should first have had a thorough training in the care of general diseases. Without this general training she may not hope to attain success in special work of any kind. The first requirement, then, to become proficient in ophthalmic nursing is a thorough grounding in general nursing. This may be had in the usual way at the numerous training schools for nurses and the hospitals with which they are

connected. Of late years some of the training schools have had arrangements with special hospitals (eye, ear, nose, and throat) by which they could give some of their students training for a few months in these special branches. While this arrangement is desirable and an advance over the old methods of no training whatever in special branches, except an occasional case, it is not adequate for present day requirements.

In order to become a proficient ophthalmic nurse, at least twelve months' service in a special ophthalmic hospital is necessary, while double this length of time in such an institution would not be too much time in the majority of instances. In such an institution not only is a familiarity with the appearance of the different affections of the eyes obtained, but the proper methods of handling and caring for such diseases are taught; also the preparations of the different dressings and bandages for the eyes are taught, as well as the preparation of patients for the different operations on the eye.

The art and technique of cleansing an eye, familiarity with the various instruments used upon the eye, the proper after-treatment of operative cases, a knowledge of the different remedies used in the treatment of the eye are all to be had in these special institutions. It is urged upon those who are desirous of becoming proficient ophthalmic nurses, therefore, first, to ground themselves in the general training; second, then in the special training in some ophthalmic hospital. In fact, this must be the course pursued by most nurses. Occasionally, without this training, a nurse may "pick up" the special nursing on her own initiative, or by the advice and assistance of some oculist, and become an expert special nurse. This is the exception, and such an instance, nowadays at least, is a rare occurrence.

A Brief Outline of the Anatomy and Physiology of the Eye.

While the purport of this little volume will not allow of an extensive review of the anatomy and physiology of the eye, yet a very brief exposition of the subject is necessary for an intelligent understanding of the care and nursing of this most delicate organ of the body—the eye.

EYEBROWS.

The eyebrows are two thickened ridges of skin, covered with short hairs, arched above the upper borders of the orbits. They serve to some extent to protect the eyes from light, dirt, and perspiration.

EYELIDS.

The eyelids, upper and lower, are two movable curtains which cover the entrance to the orbit and protect the eyeball. The upper lid is larger and more movable than the lower lid and has a special muscle, *levator palpebræ superioris,* to lift it.

The lids proper are composed of dense connective tissues, known as the tarsal cartilage.

They are attached to the margins of the orbits by means of connective tissue membranes—the tarso-orbital fasciæ. Their free edges are straight and covered with a row of hairs, the eyelashes. These lashes serve for protection to the eyes. The outer surfaces of the lids are covered with delicate skin, loosely attached to the orbicularis muscle. The orbicular muscle lies between the skin and the tarsal cartilage and serves to close the eye. The inner surfaces of the lids are lined with a delicate membrane, the conjunctiva. Imbedded in the lids are some small

glands, the Meibomian follicles. These glands open on the free borders of the lids, and furnish a sebaceous material. The opening between the free margins of the eyelids is called the palpebral fissure. It is the width of this space, larger or smaller, that gives to the eyes the appearance of largeness or smallness, and not the actual size of the eye itself. The eyes of all adults are nearly of the same size, about one inch in all of its diameters.

The eyelids serve chiefly as a protection to the eyes, and by their constant motion the eyeball is kept moist and free from dust.

The arteries to the lids are supplied in the main by the ophthalmic artery, while the veins empty into the temporal and facial veins. The lids are innervated by branches from the seventh, fifth, third, and the sympathetic nerves. The lymphatics in the lids are numerous.

LACRYMAL APPARATUS.

The lacrymal apparatus consists of two portions: a secreting—the conjunctiva and lacrymal gland; and a conducting—the lacrymal canals, the lacrymal sac, and the nasal duct.

The gland, a small almond shaped body, lies in a fossa at the upper outer angle of the orbit. About twelve small ducts lead from it and carry its secretions to the surface of the conjunctiva at the upper outer end of the upper lids. This secretion keeps the inner surface of the lids moist.

At the inner ends of the lids, upper and lower, are two small openings, puncta lacrymalia, from which small openings, the lacrymal canals, lead into the lacrymal sac.

From the lacrymal sac a small duct (lacrymo-nasal) leads into the nose, opening on the floor of the same. Through these openings the tears drain into the nose. The

tears drain into and through these very small lacrymal canals (about 1 millimeter in diameter) by capillary attraction, and not by force or gravity. This is a slow process, and when the tears are in excess, as in weeping, they run over the cheeks because of the inability of the tear-ducts to drain them through the nose. The lacrymal gland is supplied with blood from the ophthalmic artery, and is innervated by the fifth and the sympathetic nerves.

OCULAR MUSCLES.

Six muscles, four straight recti and two oblique, give to the eye its varied motions. They are: the superior rectus, inferior rectus, internal rectus, external rectus, superior oblique, and inferior oblique. They are designated as the extrinsic muscles of the eye, while the ciliary muscle and the sphincter muscle of the iris are termed the intrinsic muscles of the eye.

The four recti muscles arise immediately around the optic foramen, partly from a tendinous ring and partly from the optic foramen itself. From this origin they pass forward, diverging as they advance until they come in contact with the eyeball just behind its equator. Keeping in contact with it, they pierce its sheath (Tenon's capsule) from $^1/_8$ to $^1/_3$ inch back of the corneal margin to become inserted into the sclerotic coat, by tendinous expansions—one above, one below, one to the inner side, and one to the outer side of the eyeball.

The superior oblique muscle arises near the optic foramen, passes forward through a pulley attached to the upper inner angle of the orbit, and then is deflected backward beneath the superior rectus muscle to become attached to the posterior outer surface of the eyeball.

The inferior oblique arises from near the inner anterior angle of the orbit, passes outward and backward beneath the eyeball, and becomes attached to the posterior outer surface of the eyeball. The recti muscles move the eye up and down, in and out, while the oblique muscles give to the eye a rotary motion. In many, in fact most, of the movements of the eye, all of the muscles take part.

The muscular branches of the ophthalmic artery supply blood to the extrinsic muscles of the eye. The venous blood is emptied into the ophthalmic and facial veins.

The sensory nerves are from the fifth. The motor nerves to the muscles are: the third to the internal, superior and inferior, recti, and to the inferior oblique, muscles; the fourth to the superior oblique. and the sixth to the external rectus.

There are special centers governing the co-ordinate actions of the ocular muscles, while their voluntary actions are governed by centers situated in the cortex of the brain.

CONJUNCTIVA.

The conjunctiva is the mucous membrane lining the inner surface of the eyelids and covering the anterior half of the eyeball. The epithelial layer of the conjunctiva is transparent and extends entirely across the cornea, forming the anterior layer of that structure. At the inner corner of the eye the conjunctiva forms a crescentic fold, *plica semilunaris;* and resting upon this fold is a small red mass of tissue, *caruncula lacrymalis.* The conjunctiva is richly supplied with blood from the branches of the ophthalmic artery, while its nerve supply is derived chiefly from the seventh nerve.

Besides assisting to retain the eyeball in position, the chief function of the conjunctiva is to form a smooth cover-

ing for the inner surfaces of the eyelids and the outer surface of the anterior half of the eyeball, and by its secretion to keep the opposing surfaces moist and lubricated, allowing of free movement without friction.

CORNEA.

The cornea is a perfectly clear and transparent membrane forming the anterior one-sixth of the external surface of the eye. It is about 1 millimeter in thickness and composed of five layers, from before backward, as follows: (1) epithelial layer, a continuation of the epithelium from the conjunctiva; (2) anterior limiting membrane (Bowman's); (3) true corneal tissue; (4) posterior limiting membrane; (5) endothelial layer. The chief function of the cornea is to transmit and refract rays of light entering the eye.

The nerve supply of the cornea is from the fifth nerve. The cornea has no blood-vessels and depends for its nutrition upon the lymph thrown out from loops of blood-vessels near its margins. There are lymph-spaces in the corneal tissue for the circulation of this nutritious material.

SCLERA.

The sclera is a dense, white, fibrous membrane which, together with the cornea, forms the complete outer tunic or coat of the eyeball, the cornea forming the anterior one-sixth and the sclera the posterior five-sixths. That portion of the sclera seen between the lids when open is commonly called the "white" of the eye. Owing to its density and firmness it protects the inner and more delicate coats of the eye, the choroid and retina. It also maintains the shape of the eye, being assisted in this, however, by the vitreous, which fills the interior of the eye.

The blood-vessels of the sclera are the ciliary arteries from the ophthalmic.

AQUEOUS HUMOR.

The aqueous humor is a clear, serous fluid filling the anterior chamber of the eye. It is composed chiefly of water, with a small amount of albumin and chloride of sodium. It is secreted by the blood-vessels of the iris and ciliary body, and is quickly reproduced when evacuated by a puncture of the cornea. It fills both portions of the anterior chamber of the eye. The anterior chamber is the space between the posterior surface of the cornea and the anterior surface of the iris. The posterior part is the space between the posterior surface of the iris, near its periphery, and the anterior surface of the lens, near its periphery. The aqueous humor helps to maintain the shape of the eye and allows free movement of the iris.

VITREOUS HUMOR.

The vitreous humor is a transparent, gelatinous substance filling the interior of the eyeball back of the crystalline lens. It is surrounded by a very delicate, transparent membrane. The vitreous has no nerves or blood-vessels. It depends for its nutrition upon the lymph thrown out from the blood-vessels of the adjacent structures, the uveal tract and retina. The chief function of the vitreous body is to maintain the shape of the eye, and to keep the contiguous structures in position; that is, the retina from becoming detached, and the lens from dislocation.

CRYSTALLINE LENS.

The crystalline lens is a perfectly transparent lentil-shaped body surrounded by a transparent, elastic membrane

(its capsule) and held in position just back of the pupil of the eye by means of a suspensory ligament, the zone of Zinn. It is composed of fibers held together by a delicate, transparent, cement substance. Water, albuminous material, and a small amount of fat, with a trace of cholesterin, enter into its composition. In young subjects the lens and capsule are quite elastic in nature; but, as the subject gets older, the lens loses part of its watery element, the fibers become dryer and harder and lose elasticity, and at the age of 40 years or thereabouts old sight supervenes, due chiefly to a flattening of, and a lack of elasticity in, the crystalline lens. The lens, like the vitreous, is without nerves and blood-vessels, depending for its nutrition upon the lymph thrown out from the blood-vessels of the iris and ciliary body. The function of the crystalline lens is to assist in bringing rays of light to a focus on the retina. In consequence of its elasticity and the action of the ciliary muscle its refractive power is variable.

UVEAL TRACT.

The uveal tract forms the second, or middle, tunic of the eye. It is composed of the *choroid, ciliary body,* and the *iris.*

CHOROID.

The choroid is a thin and very vascular membrane, extending from the entrance of the optic nerve into the eye, forward, between the sclera and retina, to where it joins the ciliary body. It is composed chiefly of blood-vessels. Its layers from without inward are: (1) *lamina fusca,* (2) *tunica vasculosa,* (3) *membrana chorio-capillaris,* and (4) *lamina vitrea.*

The structure of the choroid being highly vascular, its chief function, together with the ciliary processes, is to sup-

ply nutrition to the structures lying adjacent,—the lens, vitreous, and outer layers of the retina,—which are deficient entirely or partially of blood-vessels. The large veins in the choroid are called *venæ vorticosæ.* They pierce the sclera obliquely and empty into the ophthalmic vein. The nerve supply is from the fifth and sympathetic nerves.

CILIARY BODY.

The ciliary muscle forms the middle zone of the uveal tract, connecting the choroid behind with the iris in front. It is composed of the ciliary muscle and the ciliary processes.

The ciliary muscle arises from the sclera just at the junction of the cornea and sclera; its outer longitudinal fibers extend backward to be inserted into the choroid, while its inner fibers take a circular course and form the circular fibers of Müller. From the surface of the ciliary processes connective tissue fibers spring, forming the zonule of Zinn. These fibers are attached to the capsule of the crystalline lens, and it is by their aid that the lens is held in position.

The ciliary muscle is the principal agent in adjusting or accommodating the eye to see objects distinctly at different distances. The accommodation of the eye is effected as follows:—

In describing the crystalline lens we said it was elastic, and that it was surrounded by a capsule, likewise elastic. Attached to the capsule are connective tissue fibers (zonule of Zinn), which are also attached to the ciliary processes and ciliary muscle. When the ciliary muscle is not acting these zonule fibers are stretched taut and draw on the lens capsule, which in turn compresses the lens. The lens in this way is flattened and the focus of the eye adjusted for distant objects. On the other hand, when the eye is to be ac-

commodated for near objects the ciliary muscle contracts, drawing the zonule fibers forward, thus relaxing them; they in turn relax the tension on the capsule of the lens, and the lens, being elastic, expands, becoming more convex, and in this way the eye is adjusted for seeing near objects. During the act of accommodation, in addition to the lens becoming more convex, the pupil contracts, the pupillary margin of the iris moves slightly forward, being pushed by the anterior surface of the lens, which advances a little as it becomes more convex. The posterior surface of the lens becomes a little more convex, but does not move forward.

The ciliary processes are very richly supplied with blood. A nutritious lymph is thrown out from them which nourishes the lens, and the anterior portion of the vitreous.

IRIS.

The iris is the third and anterior zone of the uveal tract. It is a thin membrane arising from the anterior surface of the ciliary body. It has a central perforation, the pupil. The layers from before backward are: (1) *endothelial layer,* (2) *vascular layer,* (3) *muscle-fiber layer,* (4) *posterior limiting membrane,* and (5) *pigment layer.*

The iris aids in the act of vision by controlling the amount of light going into the eye, and by cutting off the marginal rays of light. It is supplied with blood from branches of the ophthalmic artery. Its nerve supply is from the fifth, the third, and sympathetic nerves.

RETINA.

The retina forms the inner tunic of the eye, and extends from the optic nerve entrance forward to the posterior extremity of the ciliary body, where its nerve elements end in a serrated border, *ora serrata.* The pigment layer

of the retina, together with its connective tissue elements, reduced to a single layer of cells, continues on the inner surface of the ciliary body and on to the posterior surface of the iris even to the margin of the pupil. In the living subject the retina is almost transparent, having a whitish-gray, filmy appearance, when viewed by the ophthalmoscope. It is composed of ten layers; from within outward they are: (1) *internal limiting membrane,* (2) *optic-nerve fiber layer,* (3) *ganglion-cell layer,* (4) *internal molecular layer,* (5) *internal nuclear layer,* (6) *external molecular layer,* (7) *external nuclear layer,* (8) *external limiting membrane,* (9) *rods and cones layer,* and (10) *pigment layer.* The layer of rods and cones is the perceptive layer of the retina. Situated in the center of the retina in the posterior portion of the eye is a yellow spot, *macula lutea.* At the center of this spot is a depression, *fovea centralis,* which is the center of direct vision and is the most sensitive portion of the retina. The retina is supplied with blood by the *arteria centralis retinæ,* a branch from the ophthalmic which pierces the optic nerve just back of its entrance into the eyeball. The branches from this artery lie in the outer layers of the retina, and terminate in *free endings,* no anastomoses taking place. The retinal veins empty into the ophthalmic vein.

OPTIC NERVES.

The optic nerves are nerves of a special sense, that of sight. They have their origin in the brain as the optic tracts which emerge from its under-surface at the posterior portion of the optic thalami by two roots. Fibers from these roots extend to the cortex of the occipital lobe of the brain, where the visual center of the brain is situated. The optic tracts decussate anteriorly; that is, about three-fifths

of the fibers from the right tract cross over to the left optic nerve and three-fifths of the fibers of the left tract go over to the right optic nerve. This crossing of the optic tract fibers forms the optic chiasm. The length of the optic nerves from their origin in the optic chiasm to the eyeball is about 1 inch. The optic nerves are surrounded by sheaths which are direct continuations of the membranes surrounding the brain. The spot where the optic nerve enters the eye is known as the optic disc. The blood supply to the optic nerve, chiasm, and optic tracts is derived chiefly from the branches of the internal carotid and vertebral arteries. The function of the optic nerve and tracts is to transmit visual impressions to the brain. The conscious preception of the visual impressions gives sight.

ORBITS.

The orbits are the bony cavities in which the eyeballs are contained and by which they are protected. They are funnel shaped; the large end of the funnel is directed forward and the small end backward, terminating in the optic foramen through which the optic nerve enters the orbit and also the ophthalmic artery. Near the posterior end of the orbit is another opening, the sphenoidal fissure, through which pass the third, fourth, ophthalmic division of the fifth and sixth nerves, and the ophthalmic vein. The bony orbit is lined by a layer of dense connective tissue; fibers spring from this connective tissue which expand into sheaths. One of these sheaths surrounds the optic nerve and the eyeball, except the front portion, and in this capsule the eyeball turns as in a ball-and-socket joint. The posterior part of this membrane is called Bonnet's capsule, and the anterior portion Tenon's capsule. At the apex of the orbit is a cushion of fat, which supports the eyeball. In

wasting diseases, as consumption, when this fat is absorbed the eyes become sunken or hollow from lack of support.

EYEBALL; ACCOMMODATION; BINOCULAR VISION.

The function of the orbits is to furnish protection to the eyeballs. The eye as a whole may be likened to a camera. At the front surface are the cornea and lens to *focus* the rays of light; and the iris with its central perforation, the pupil, which can be changed in size, to regulate the amount of the light; while the retina at the back of the eye is the sensitive plate upon which the images are received. As this plate cannot be moved backward and forward, as in a camera, the ciliary muscle is brought into use in order to have clear images of objects at varying distances formed on it. By the action of this muscle and the elasticity of the crystalline lens itself the lens can be made to change its convexity. In this way the images of objects at different distances can be accurately focussed on the retina, and *this is the act of accommodation.* The impressions of these images are transmitted to the sight-perceptive center of the brain by means of the optic nerves and tracts. The images of all objects fall on the retina in an inverted position; that is, upside down; nevertheless they are interpreted by the brain as being erect, or upright. Moreover, the images of an object formed in each eye separately are fused into one which is seen singly. When the two eyes are not directed straight to an object, but one deviates so that the image of the object does not fall directly on the center of the retina, the *macula lutea,* double vision follows, as a rule. Just how the brain is able to perceive these inverted images on the retina as *erect* and *single* we are unable to understand, and it has resulted in much discussion and speculation.

CHAPTER II.

CONTAGIOUS DISEASES OF THE EYE.

Definition of Contagion and Infection—Epidemic and Endemic—Germ Theory of Disease—Definition of Antisepsis and Asepsis—Catarrhal Conjunctivitis—Gonorrheal Conjunctivitis—Ophthalmia Neonatorum.

By contagious diseases of the eye we mean those diseases which can be transmitted either directly or indirectly from one eye to another. In all contagious diseases of the eye there is more or less discharge from the eye, and it is by some of this matter from the diseased eye to a healthy eye—from one eye to the other in the same person or to another individual—that the disease becomes communicable or contagious.

In this matter are micro-organisms or bacteria, each disease having a germ peculiar to itself, as has been demonstrated in recent years in many diseases by means of the microscope. When a small amount of this pus is transferred from a diseased eye to a healthy one, it usually produces a similar disease in the healthy eye.

In all of the contagious diseases of the eye, except one, trachoma, a specific germ has been found to be present peculiar to each disease. In trachoma no specific germ or microbe has been settled upon as a definite cause of the disease, although two or three observers (Michel, Sattler) claim a specific germ (a diplococcus) for its origin.

Before the germ theory of disease was advanced it was difficult to explain just how a contagious disease was transferred from one individual to another, but, since the discovery that each contagious disease has a specific germ

causing it, it is easy to perceive in what manner such diseases are transferred and how produced.

The contagious diseases of the eye are: catarrhal conjunctivitis, or "pink eye"; gonorrheal ophthalmia; ophthalmia neonatorum; diphtheritic ophthalmia; trachoma, or granulated eyelids. Of these diseases the first four are highly contagious, the smallest particle of secretion from an eye affected with any one of them when transferred to a healthy eye being sufficient to produce a similar disease in the latter. Usually in these diseases, when the second eye becomes affected in the same individual, the disease runs a milder course than in the first eye to become affected.

Trachoma is only mildly contagious, and usually an eye has to be exposed to the contagion time and again before it becomes affected. When once contracted, however, the disease is difficult to get rid of.

By a few authorities these contagious diseases are thought to be infectious; that is, transmitted through the air. While it is possible to conceive of particles of the matter from eyes affected with these diseases becoming dried and then wafted through the air into healthy eyes and setting up a like disease, it is not at all probable. The danger from such source of infection is hardly worth while considering. For, as shown by the experiments of Piringer, these secretions, when dried, after thirty-six hours' time became inert and incapable of infecting healthy eyes. These diseases are highly contagious; that is, communicable when the pus from a diseased eye is brought in contact with a healthy eye by means of unclean fingers, handkerchiefs, towels, etc.; but they are slightly if at all infectious through the air, as measles, mumps, etc. Actual contact of the germ, direct or indirect, is a necessary factor in the production of these diseases. The extreme importance of

absolute cleanliness on the part of the doctor, nurse, attendants, and the patient himself in such diseases is self-evident. Through uncleanliness and negligence these contagious diseases may become epidemic; that is, spread through a whole community temporarily. As, for example, through dirty public baths a great number of people may become afflicted with acute catarrhal conjunctivitis. In some instances these diseases are thought to become endemic; that is, permanently fixed in certain localities. In Egypt, for instance, trachoma has been endemic for ages; and in the southern portion of the State of Illinois on the Wabash River in a small district, aptly enough called "Little Egypt," the disease is quite prevalent and always present; hence endemic.

Having considered the causes of contagious diseases of the eye, it behooves us to say a few words here in reference to antisepsis and asepsis, a subject which will be treated more fully farther on. The word *antisepsis* means literally opposed to putrefaction or fermentation. Since micro-organisms are at the seat of putrefaction and are the cause, as we know, of many diseases, any method or means to destroy these germs is termed antisepsis. Heat, dry or moist, where it can be applied, as in sterilizing instruments, is an effective antiseptic. Carbolic acid, bichloride of mercury, alcohol, permanganate of potassium, etc., are common antiseptics with which we are familiar. They are antiseptic by reason of their power to kill germs, and are on this account also called germicides. Nitrate of silver, argyrol, and protargol are valuable germicides and they are frequently employed in the treatment of the acute contagious diseases of the eye.

Asepsis means literally the absence of putrefaction or fermentation, and also the micro-organisms upon which

they depend. Hence any method or means used to keep a wound free from germs, as by sterile solutions, dressings, etc., is termed asepsis.

In diseases of the eye strong antiseptic solutions cannot be used, the eye being such a delicate and sensitive organ. The solutions of carbolic acid and bichloride of mercury should not be of greater strength than 1 to 5000. In this strength they are only weakly germicidal. If used in stronger solution they are very irritating to the eye and many times do actual harm. For this very reason in diseases of the eye, even in the contagious diseases, we depend on aseptic methods more than antiseptic means. That is, we endeavor to keep the eye clean by frequent bathing with aseptic or sterilized solutions, or mildly antiseptic solutions. In cases of wounds and after operations we protect the eye with sterilized dressings, thus keeping the germs out. The old adage, "an ounce of prevention is worth more than a pound of cure," is quite applicable in the treatment of diseases of the eye, for it is much easier to keep these germs out than get them out when once in. This point cannot be too strongly impressed upon the nurse's mind, for an eye once infected, especially after operation, often means the loss of it.

Acute Catarrhal Conjunctivitis.

This is an acute contagious disease of the eye, many times appearing in epidemic form. It is caused by a micro-organism, the Koch-Weeks bacillus. Atmospheric conditions evidently have some influence in its production, the damp, chilly days of spring seeming to predispose to it. The disease is characterized in the beginning with redness, burning, and itching of the eyes, the lids are swollen and

red, and light hurts the eyes. After a few days' duration there is marked increased secretion of a muco-purulent nature, which sticks the eyelids together in the morning. In one or two weeks, according to the severity of the case, the disease runs its course and the patient is well, if the eye has been properly taken care of. As a rule, the medicinal treatment in such cases is very simple, and consists, for the most part, in the application of silver nitrate, 2 per cent. solution (10 grains to 1 ounce), to the lids once a day, or some other mildly antiseptic application according to the bent of the surgeon. Personally I prefer the silver nitrate application to all other remedies in this affection. The patient may use a 25 per cent. solution of argyrol at home.

The care and nursing of these cases is important, not only in knowing what to do with them, but what not to do. Sometimes we need to be delivered from our friends, and if there is one disease of the eyes more than another in which patients need to be delivered from "grandmother" remedies and quack nostrums it is this disease. The diagnosis given in such cases by these ignorant, dangerous, and free givers of advice is that of a "cold in the eyes," which may mean anything from a cinder on the cornea to the most virulent cases of diphtheritic conjunctivitis.

The treatment recommended by these sometimes innocent, but always ignorant and presumptuous, practitioners of the healing art, to be applied to the most delicate organ of the human body, the eye, may be anything from bathing the eyes in breast-milk, the application of poultices, of tea-leaves, bread and milk, flaxseed, etc., raw meat, oysters, skin of egg, cow dung, a piece of the placenta of a parturient woman, and even to bathing the eyes in the patient's own urine, from which last practice more than one eye has been infected with gonorrheal ophthalmia and the sight de-

stroyed. It seems hardly necessary for me to warn any intelligent person from carrying out such practices as the above mentioned, yet there are so-called intelligent people, and not a few of them apparently, who do practice them. A campaign of education is in order, therefore, and I know of no better time, place, or opportunity than now to start it.

If called upon to write or formulate the two most important precepts in ophthalmic nursing I should do so as follows:—

1. Thou shalt be altogether clean and gentle when caring for the eyes.

2. Thou shalt not apply poultices to the eye.

I wish that these two short precepts might be indelibly impressed on the mind of every nurse and grandmother, or other person presuming to nurse, to the end that the sight of many eyes might be saved.

Since Pasteur's discovery that fermentation and putrefaction are due to the presence of certain micro-organisms, or "germs," we have learned that most, if not all, contagious diseases (as well as many non-contagious diseases) are caused by germs and their toxins (their poisonous excretions). We know also that it is necessary to get rid of these micro-organisms before we are truly clean. The methods of getting rid of these germs, as by the use of heat, germicidal solutions, etc., are termed antisepsis, and were first introduced by Lord Lister. The means used to keep free of these germs, as by soap and water, dressings, etc., are termed asepsis. For full particulars in antisepsis and asepsis see Chapter V.

That poultices should never be applied to an eye affected with a contagious disease is self-evident to the surgical mind, and for two reasons; first, they retain the irritating secretion in the eye; secondly, they often strip

the delicate epithelium from the cornea and conjunctiva, leaving ulcerating surfaces open to the contagion, and not infrequently in this way causing the loss of the eye. The use of poultices, therefore, should never be resorted to in contagious diseases of the eye. They are dirty, dangerous, and altogether an abomination, as well as destructive to the sight of man. If heat and moisture must be applied to the eye, let it be in the form of hot water, with which the eyes may be bathed frequently; or applied by means of pledgets of cotton or old, soft, clean linen, dipped into the water and laid upon the closed eyes.

In the mild cases of catarrhal conjunctivitis the patient himself is usually able to care for his own eyes, but in the severer types, where the secretion is very abundant and accompanied at times with ulcers of the cornea and exceptionally with membranes on the lids and even with an iritis, the services of a nurse are called for. In any case the eyes should be cleansed with a warm (98° to 100° F.) sterilized solution sufficiently often to keep them free of the secretion. A teaspoonful of boracic acid or of table salt to the pint of water, and plain sterile water (made so by boiling then cooled), are good for cleansing with. This should be done every half-hour, if necessary, and is the most important factor in the treatment of the disease. The technique of cleansing an acutely inflamed and sensitive eye is not so simple a matter as it seems. The "touch" of some nurses, also of some doctors, in manipulating these cases, is as the tread of an elephant. So patients sometimes think and say. There is a certain aptness or deftness in the art of cleansing an eye gently and well that can be acquired only by the exercise of close attention and much patience. This deftness is natural to some and is never acquired by others.

DIRECTIONS FOR CLEANSING AN EYE.

The nurse herself should have surgically clean hands, wear a pair of protective glasses (if she does not already wear glasses), and on her lap have a rubber apron. All solutions, cotton, cotton applicators, pus basins, etc., should be prepared and placed on a small table near a window or other source of light convenient to the nurse. If the patient is a child, it should be wrapped in a sheet with the

Fig. 1.—Child's Head in Surgeon's Lap for Cleansing the Eye.

arms at its side, to prevent the child from interfering with the cleansing.

Over the sheet and well up under the chin a towel should be placed for protection to the patient. The child is held in the lap of an attendant and with its back to the nurse who pulls the child's head backward and places it between her knees, as shown in Fig. 1. With the head firmly fixed between the knees the lower lid is gently pulled down by placing the thumb on the cheek just beneath the eye, exposing the inner surface of the eyelid and the lower *cul-de-sac* (the deep fold of conjunctiva joining the lid to the

eyeball). Then a stream of water squeezed from a pledget of cotton held in the free hand is directed on to the inner surface of the lid. This maneuver is repeated until all the loose pus is washed away. If any pus remains sticking to the lids or eyelashes, this may be gently wiped away with the moistened cotton. To cleanse the upper lid and *cul-de-sac* it is necessary to catch the eyelashes of the upper lid between the thumb and forefinger of one hand, and pull the eyelid forward and away from the eye; pressure downward is then made at the upper edge of the cartilage, when, as a rule, the lid is everted and its inner surface and upper *cul-de-sac* are exposed to view. Then direct a stream of water squeezed from a pledget of cotton into the groove between the lid and eyeball and on to the lid surface, repeated often enough to wash away the pus. If much pus should remain in the *cul-de-sac,* it may be wiped away by means of a moistened piece of cotton on an applicator. If the eyelids are so swollen that they cannot be lifted from the eye, it is much better that the surgeon perform a canthotomy (cutting the lids at the outer corner of the eye with a scissors), when the eyes can be readily cleansed after the manner just described.

All rubber bulbs with narrow tips on them for insertion under the lids to irrigate the *cul-de-sac* should, in my opinion, be abandoned as dangerous. In using them, especially in young children, we are apt to injure the cornea. With the simple cotton pledgets we are much less apt to do harm to the eye. If it becomes necessary to perform a canthotomy, no harm is done, but rather advantages gained, as follows: Pressure of the lids is taken from the eyeball, and the risk of ulceration of the cornea is less liable; the eyes can be cleansed more easily than before; local bloodletting is accomplished, which relieves the congested and

inflamed eye. The wound from such operation heals in about one week's time and leaves no scar.

The fewer the instruments the less the danger to the patient, is a good surgical maxim, and it is especially applicable to the eye.

The second step in caring for a case of catarrhal conjunctivitis is the application of iced cloths or cold compresses. Have by the side of the patient's bed a large bowl or dish in which place a cake of ice the size of a man's head. On this cake of ice place a half-dozen pledgets of old, soft, white linen or cotton about 2 inches square; or, better still, pledgets of absorbent cotton, moistened; allow them to remain on the ice till cold (ten minutes); then take one, or two, if both eyes are affected, and lay them on the closed eyelids. After two minutes take these pledgets off the eye, and place them back on the ice, then place two fresh pledgets on the eye. Keep changing the pledgets in this manner every two minutes for half an hour. This should be repeated four, five, or six times during the day, and, if the blennorrhea is very marked, even oftener.

If ice is not to be had, these pledgets of cotton or cloth may be dipped in cold water and applied in the manner above indicated. The practice of putting cracked ice into a little rubber bag or wrapped in a towel or other cloth and laying the same on the eye is a bad one, for the reason that it puts too much weight and pressure on the sensitive eye. It often does harm rather than good.

Cleansing the eyes and applying cold compresses are the two most important duties of a nurse in such cases. The physician in charge usually makes the necessary medicinal applications.

The most valuable remedy in these cases, at least it has been in my hands, is an application to the everted lids

of a solution of silver nitrate, 10 grains to the ounce. The application is made as follows:—

If the patient is a child the head is held between the knees as in cleansing the eye; after cleansing the eye, the lower lid is pulled down by placing the thumb on the cheek

Fig. 2.—Showing how to Evert the Upper Lid Standing Back of the Patient.

at the lower part of the lid. Then an applicator with a small amount of cotton wrapped smoothly on it and saturated with the silver solution is rubbed gently over the inner surface of the lid and deep into the lower *cul-de-sac.* The lid is then let loose to come back into position. Next. the lashes of the upper lid are caught between the thumb and forefinger and the lid pulled gently forward away from

the eye; then pressure is made with the blunt end of the applicator or the tip of the finger at the upper edge of the cartilage (see Fig. 2) and the lid everted. The silver solution is then applied to the exposed surface and *cul-de-sac.*

It takes a certain amount of deftness to evert the upper eyelid gently and without pain, especially when it is swollen. It should be practised frequently on the healthy eye before undertaken on the diseased organ. The eversion of an eyelid seems like a matter of exceedingly small importance to the surgeon and the nurse, but it is not so considered by a sensitive patient. I have known of more than one instance where the nurse lost charge of the case because she could not turn an eyelid properly. The essential point in the technique is first to pull the lid well away from the eyeball, then make the pressure at the upper margin of the cartilage downward and rather quickly.

There is one other matter which should be spoken of here and that is the art of wrapping cotton on an applicator quickly, smoothly, and so that it will stick; also that it can be taken off when through with. Take a piece of cotton ½ inch wide, 1 or 2 inches long, and 1/16 (approximately) inch thick; catch one end of it between the thumb and fore-finger of one hand, place the extreme tip of the applicator on the cotton held between the thumb and finger, hold it firmly with the thumb and finger, then twist the applicator with the other hand (and not the cotton as is so often done), and the cotton will at once adhere to the tip of the applicator. The tip should be covered completely first and to the depth desired, then the applicator should be pushed through the finger and thumb as it is turned so as to cover about from 1 to 1½ inches of the applicator. At the upper end only, that is, nearest the handle of the applicator, the cotton should be wound very tightly, the edge of the

thumbnail being held against it for this purpose while the applicator is turned. This prevents the cotton from coming off when in use. When ready to take it off, hold the cotton firmly between the thumb and finger of one hand, and a slight reverse twist of the applicator is all that is necessary.

Camel-hair brushes should not be used for making applications to the eyelids, because, unless disinfected after use on each patient, they are liable to carry infection. Cotton placed on an applicator as just described is much preferable, for this is used but once and is then destroyed.

The "eye sponge" has been displaced by cotton, and the camel-hair brush is doomed to a like fate.

The hygienic surroundings of the patient when affected with catarrhal conjunctivitis of the severer types is of importance.

The room should be kept moderately darkened for these patients; the diet should be light, but nutritious; the bowels kept freely open, and no smoking or stimulants allowed. The floor, which should be uncarpeted, should not be swept, but mopped up, and all dressings immediately destroyed after use. It seems almost unnecessary to warn the nurse that she should be very careful with her own person, washing and disinfecting her hands often, and never rubbing or touching her own eyes. A solution of bichloride of mercury (1 to 1000) in a basin should always be near to dip her hands into after washing them with tincture of green soap.

Gonorrheal Conjunctivitis.

The safety of an eye when affected with this frightful malady, causing as it does in adults and infants about one-fourth of all cases of blindness, depends more on the intelligent and faithful care of a trained nurse than the minis-

trations of a doctor. The disease is caused by infection with the germ or the micro-organism of gonorrhea, the gonococcus, discovered by Neisser. The disease may affect adults or infants; in the former, it is usually designated gonorrheal ophthalmia, and in the latter ophthalmia neonatorum. The two diseases are identical. The eyes of children, however, seem to withstand the disease better than the eyes of adults. In infants, when seen early (within the first twenty-four to forty-eight hours after infection) and before the corneæ are affected, the eyes are almost always saved with useful vision; but in adults, even when seen from the start, no promise can be given to the patient as to recovery with sight preserved.

In adults, the disease for the first two or three days is characterized by redness and by marked swelling of the eyelids and conjunctiva, being so great in severe cases that the patient cannot open the eyes. The conjunctiva, both of the eyelid (palpebral) and the eyeball (ocular), is hot, dry, and swollen, and the ocular conjunctiva may become so swollen and edematous as to form a ridge around the cornea, termed chemosis of the conjunctiva. There is intense pain in the eyes and over the orbits. This condition lasts for from two to four days, when the lids become softer and less swollen, and a purulent secretion flows from between them. This purulent stage of the disease lasts for from one to two or three weeks.

Ulceration of the cornea may, and often does, take place, sometimes with loss of the sight. Inflammation of the entire eyeball and orbital contents (panophthalmitis) may supervene, with total loss of the eye.

The nurse's first duty when called to take charge of a case of gonorrheal ophthalmia is to protect the unaffected eye, if but one is infected. This may be done in one of two

ways: by Buller's protective shield or by bandaging the eye.

Buller's shield is applied as follows:—

Take an ordinary watch-crystal, which is about 1½ inches in diameter, and two pieces of adhesive plaster, one of which should be 2 inches square and the other 2½ inches square; cut a hole 1 inch in diameter out of the center of each piece of plaster, paste the smaller piece to the concave (hollow) side of the watch-crystal and the larger piece to the convex (elevated) surface of the watch crystal.

The outside piece of plaster (which is on the convex surface of the crystal), being larger than the inside piece, leaves a half-inch margin of the adhesive plaster free. The watch-crystal, concave surface inward, is now placed over the unaffected eye and the free margin of adhesive plaster fastened to the face, above the eye, on the nose and below the eye, the edges of the plaster being covered with flexible collodion to hold them more securely. The temporal side is not pasted to the face, but left free to give ventilation to the eye. There is but little danger of infection, by having the temporal side open; and, if pasted down, moisture from the eye forms a mist on the glass crystal and prevents the patient from seeing with the eye, as well as preventing a view of the patient's eye by the physician.

In infants and very restless patients, it is better to cover the well eye with a pad of gauze and a roller bandage, which is not so easily pulled off. (For method of applying a protective bandage, see Chapter X.) This bandage should be removed twice every day, the eye washed, and then the bandage reapplied.

Cleansing the affected eye, or eyes, as the case may be, is the next most important and urgent duty of the nurse.

For the first day or two after the inception of the disease there is, as a rule, but scanty secretion; but after the third or fourth day the secretion from the eyes is copious. This pus should not be allowed to remain in contact with the eye, as it becomes a source of irritation to the eyeballs, and may cause ulceration of the cornea, a complication we wish to avoid if possible. In very severe cases, where the pus collects quickly, it should be removed every twenty to thirty minutes, and in less severe cases every half-hour to one hour. The frequency with which an eye should be cleansed will depend upon the judgment of the doctor and the observation of the nurse. Pus should not remain in contact with the eye, and when enough is collected between the lids to be noticeable to the attendant it should be removed at once. A day nurse and a night nurse are necessary in such cases; at night the cleansing should not be as frequent as in the day,—perhaps about one-half as frequently. This is to allow the patient an opportunity to sleep. If the patient is kept awake too much, his general condition is weakened, and this in itself affects the eye in a bad way, and may hasten a breaking down or ulceration of the cornea.

If the lids are so swollen that the eyes cannot be readily cleansed, a canthotomy (cutting of the outer angle of the lids) should be performed by the surgeon. As remarked above, this not only allows the eyes to be cleansed easily, but takes pressure off of the eyeball, and in this way lessens the danger of ulceration of the cornea. And it must ever be borne in mind that this is a complication we wish most ardently to avoid. In cleansing the eye *the nurse should be very careful not to rub the cornea so as to abrade it,* for this leaves an open spot for infection and is almost certain to result in an ulcer.

When ulceration does take place, it should be reported at once to the surgeon, if not already observed by him, because it necessitates the instillation of atropine, at once, and usually a change from cold to hot applications.

The application of cold compresses is another important feature of the treatment in gonorrheal ophthalmia, and the nurse should be prepared and know how to make such application, which may be done in two or three ways, as already described when treating of catarrhal conjunctivitis (see page 24). Iced cloths should not be applied too frequently nor too long at a time, because they have a depressing effect on the circulation and nutrition of the eye. The circulation of the blood in the loops of blood-vessels at the periphery of the cornea is already much embarrassed by the chemosis of the ocular conjunctiva, often present in the severer cases, and the cold further depresses this circulation. While, therefore, the cold compresses relieve the pain, they should not be used too freely, but only just enough to keep down the pain and to help reduce the swelling of the eyelids. The cold compresses are of much service in the beginning of the disease and should be used for 15 minutes in each hour; but after the secretion has fully started, and in the later stages of the disease, they should be used less frequently. In fact, after the first few days cold applications should not be used, neither hot, unless there is ulceration of the cornea. If ulceration of the cornea takes place, they should be stopped at once and hot applications used in their place.

Hot applications are applied in the following manner: Have by the bedside of the patient an open metal vessel which will hold a quart to half a gallon of water. Fill with water and place on a metal stand so that an alcohol lamp can be placed beneath. The temperature of the water

should be raised to 110° F. Then pledgets of cotton or old linen are dipped into this, wrung out, and placed on the eye. These pledgets should be changed every minute or two, for 30 minutes; then rest 30 minutes, or an hour, as the case may demand, when they should be repeated. This should be done several times a day according to the directions of the surgeon.

If an alcohol lamp is not convenient, hot water may be taken frequently in a pitcher from a pot or kettle on the stove, and the pledgets of cotton dipped in this and placed on the eye. The objection to this method is that the water soon cools in the pitcher and is of variable temperature, while the alcohol flame keeps a constant temperature.

The application of remedies to the lids in these cases is usually made by the surgeon or his assistant in charge, but often the nurse is called upon to make them, especially the instillations of drops and lotions.

In the very early stages of the disease we may modify it (and some surgeons claim to abort it) by applying to the everted lids and down deep within the *cul-de-sac* a strong solution of silver nitrate. Buller, of Montreal, advised an 8 to 10 per cent. solution, which in my opinion is entirely too strong, and on no account should a solution stronger than 4 per cent. be used, and this should be neutralized immediately with normal salt solution. Usually not more than two such applications are made, and these one day apart.

When the profuse purulent discharge sets in, about the third to fourth day, a 2 per cent. solution of silver nitrate may be applied to the lids once a day with cotton on an applicator, provided the lids can be everted. But often the lids are so swollen they cannot be everted, when a canthotomy must be performed, if this line of treatment is to

be pursued. In late years the newer preparations of silver have come into wide use in these cases—argyrol and protargol, among others, being used to the exclusion of silver nitrate altogether—these preparations have the great advantages of:—(1) being non-irritating or but mildly so; (2) that they can be used by the nurse and freely without damage to the eye; (3) that it is not necessary to make a canthotomy in order to instill the remedy; (4) in that the cornea is not so likely to be injured by instilling drops as by an applicator with cotton, by which method silver nitrate is usually applied. Of all the newer remedies I prefer argyrol and use it in 25 per cent. solution, having the nurse cleanse the eye every hour during the day, and at night, in order that the patient may get some sleep and rest, the eye is cleansed every two hours and the argyrol instilled after each cleansing.

In late years I have ceased to use cold compresses in these cases, except for the first two or three days; and no hot compresses at all unless an ulceration of the cornea occurs, in which case they are applied several times a day, following cleansing of the eye.

All dressings, cotton, linen, etc., used in connection with these cases of gonorrheal ophthalmia should be burned immediately after use. The nurse herself cannot be too careful with her own eyes, always washing her hands each time after cleansing or touching the eyes of the patient, and then dipping the hands into a strong solution of bichloride of mercury (1 to 1000). That the danger of infection of the nurse's eyes and also of the eyes of the family and friends of patients affected with gonorrheal ophthalmia is not an imaginary one, may be inferred from the following quotation from Professor Fuchs, of Vienna:—

"In the Vienna Foundling Asylum, during the years 1812 and 1813, there were for every hundred infants affected with blennorrhea (ophthalmia neonatorum) more than fifteen nurses so affected, who had acquired their eye-disease from the infants. I have seen a whole family infected with blennorrhea by a child having blennorrhea neonatorum, and thus plunged into the greatest misery." ("Text-book of Ophthalmology," page 54.)

I myself have seen more than one nurse's eyes infected with gonorrheal ophthalmia contracted from the eyes of the patient whom she was nursing. Too much stress, therefore, cannot be laid upon this matter of prevention of infection of the attendants and the neighbors of the patient afflicted with this highly contagious disease. Absolute cleanliness on the part of the nurse, protective glasses for her eyes, burning of all dressings, cotton, etc., used in cleansing the eyes, should be strictly followed out.

The room or ward in which such patients are cared for should have but little furnishing, and that plain, with no carpet on the floor; and should be well ventilated and moderately well lighted.

The general condition of the patient should be carefully attended to. Plenty of nutritious, fluid diet, and tonics, if necessary, should be given. All company should be excluded, both for the comfort of the patient and the prevention of possible infection of the visitor. The room in which such cases have been taken care of should be thoroughly disinfected before being occupied by anyone else.

Ophthalmia Neonatorum.

This disease is identical with gonorrheal ophthalmia, being caused by the same micro-organism, the gonococcus. It occurs in infants; hence the name, *ophthalmia*

neonatorum,—ophthalmia of the newborn. The symptoms are the same as in gonorrheal ophthalmia, but, as a rule, not as severe; furthermore, the eyes of infants withstand the inflammation better than the eyes of adults. Where ophthalmia neonatorum is seen in time, within forty-eight hours after infection, a favorable prognosis may be given. This is not so in adults when infected; no matter how soon the disease comes under observation or how energetic the treatment pursued, the vision of many eyes is destroyed by it, and the prognosis should always be a guarded one. For instance, I have known a nurse to lose her eyes as the result of gonorrheal ophthalmia contracted from nursing an infant with ophthalmia neonatorum, the infant in the meantime recovering with good vision.

Ophthalmia neonatorum is contracted from the genital organs of the mother during parturition, or immediately afterward when the child is bathed. Every obstetrical nurse should be taught this fact. The vagina of every parturient woman who has a vaginitis should be douched with a warm, antiseptic solution (1 teaspoonful of carbolic acid to a quart of water) just before delivery. After birth the child's eyes should be washed in water from a small bowl, and not from the tub in which the child's body is bathed. After the lids have been carefully bathed and dried, by direction of the doctor in charge, 1 drop of a 2 per cent. solution of nitrate of silver should be dropped between the lids into the eyes, as first suggested by Credé, and especially should this be done if there has been any vaginitis whatever in the mother. By this method, in the Lying-in Hospital of Leipzig, Credé reduced the number of cases of ophthalmia neonatorum from 10.8 per cent. (which prevailed before his method was used) to 0.2 per cent. With such a showing, it seems to me the doctor's duty to order and the nurse's duty

to follow this method of treatment is imperative in every case of childbirth. And this, no matter whether there is a vaginitis in the mother or not. Even if there is no disease of the eye, 1 drop of a 2 per cent. solution of silver nitrate does no harm; and often, as shown by statistics, does a great deal of good by preventing the disease. In the last few years, argyrol, in 25 per cent. solution, dropped into the infant's eyes immediately after birth, has been a favorite remedy with many physicians.

The nursing of an infant's eyes affected with ophthalmia neonatorum is about the same as that followed in the care of an adult with gonorrheal ophthalmia, differing somewhat in but one or two particulars. When but one eye is affected, a protective bandage should be applied instead of the Buller's shield, which latter would likely be pulled off by the little patient. Again, the lids are very small and much more difficult to handle, and it is often necessary, on this account, to use a very small and delicate lid retractor to elevate the upper lid in order to cleanse the eye properly. To introduce this retractor under the upper lid without injury to the eye it is necessary to place the forefinger of one hand on the skin of the upper lid, about ½ inch above its free margin, and make gentle traction. This lifts the free margin of the lid from the eyeball when the retractor can be gently introduced under it. Once under, the lid can be held up out of the way while the eye is cleansed.

If the swelling of the lids is so great that the retractor cannot be easily introduced, a canthotomy should be performed by the surgeon; after which it is quite an easy matter for the nurse to evert the lids and cleanse the eyes. The canthotomy is of direct benefit also, as pointed above, by taking pressure of the eyelid off the eyeball, and by

reason of the local bloodletting. Complications, as ulceration of the cornea, should be treated in the same manner as when occurring in gonorrheal ophthalmia in adults.

Perhaps 95 per cent. of all eyes affected with ophthalmia neonatorum should be saved with useful vision, if only seen in time. Unfortunately many of the poorer classes in large cities are attended by midwives during confinement, and the infant is often allowed to go for days or weeks with a "cold in the eyes" before the child is brought to a doctor. This so-called "cold in the eyes" only too often is ophthalmia neonatorum, and frequently the child's eyes are hopelessly lost or greatly injured when first seen by the doctor. For this reason, this disease, which is easily prevented when Credé's method is used, and which is so amenable to treatment, when seen in time, is the cause perhaps of one-sixth of all cases of blindness. A rather sad commentary in this day of antiseptic and aseptic surgery!

In the State of New York a law has been passed making it a felony on the part of a midwife or other attendant, not a doctor, if sore or inflamed eyes in a newborn infant is not reported at once to a doctor. And the punishment may be a fine, or imprisonment, or both.

CHAPTER III.

MEMBRANOUS CONJUNCTIVITIS (CROUPOUS AND DIPHTHERITIC).

Croupous Conjunctivitis—Diphtheritic Conjunctivitis—Traumatic Membranous Conjunctivitis.

Clinically we recognize two varieties of membranous conjunctivitis: *croupous* and *diphtheritic*. Considered from their microbic origin, however, the distinction or differentiation between the two forms is not so easily made; for the Klebs-Loeffler bacillus, which is supposedly the cause of every case of diphtheritic conjunctivitis, is sometimes absent in the most virulent clinical forms of the disease, while the same bacillus is sometimes present in the mildest cases of croupous conjunctivitis. The history of the case and clinical appearances must be depended upon, therefore, in a large measure, in arriving at a correct diagnosis in these cases. All such cases should be isolated from the start, and especially so if there is any suspicion of the diphtheritic form being present, since this latter variety is highly contagious. Every nurse should be familiar with the symptoms (both the local and general) of membranous conjunctivitis: first, for the benefit of the patient, and, second, for her own protection and the safety of the public.

Croupous Conjunctivitis.

The symptoms in the early stage of the disease are burning, pain, redness, and swelling of the eyelids, as in an ordinary purulent conjunctivitis. On the second or third day, however, a grayish-white membrane forms on the

conjunctival surface of the lids and in the deeper folds (*culs-de-sac*) of the conjunctiva covering the eyeball itself. This membrane may be in small patches or cover the whole surface of the conjunctiva of the lids. As a rule, it can be wiped off easily with a pledget of cotton, leaving a raw surface beneath, which sometimes bleeds. The superfical position of this membrane, it being confined to the epithelial layer of the conjunctiva, and the ease with which it can be removed, distinguishes this form of membranous conjunctivitis from the true diphtheritic variety. In the latter disease the membrane is really an exudate into the deeper layers of the conjunctiva and cannot be wiped off at all.

Again, in croupous conjunctivitis, the lids, though swollen and red, do not become stiff and of a "leathery" hardness as in the true diphtheritic form of the disease. The general or systemic symptoms also are much milder in croupous than in diphtheritic conjunctivitis.

Three or four days after the inception of croupous conjunctivitis, the membrane begins to loosen and come away, sometimes in small pieces and at times in a mass, when the disease assumes more or less the character of a purulent conjunctivitis, and is to be treated and cared for as such. The membrane may re-form one or several times.

As the disease is contagious (the streptococcus usually being present), the patient is to be isolated, and, if but one eye is affected, the other is to be protected by a Buller shield or bandage. In the early stages of this disease, caustics or strong applications of any kind (as silver nitrate, bichloride of mercury, etc., in strong solutions) are to be avoided, because these preparations themselves, in concentrated form, are capable of forming membranes on the conjunctiva. All that is necessary for the nurse to do, after isolating the patient and protecting the eye,

is to keep the affected eye clean with a saturated solution of boric acid, and apply cold cloths to the eye in the very early stage of the disease. After the second day, if there is still pain, hot applications should be made in place of the cold, as the vitality of the eyes in these cases is reduced and cold has a tendency to reduce it even further. The membrane should be wiped gently from the lids once a day. This can be done as follows: Evert the upper lid; then, with a piece of cotton wrapped on an applicator and moistened in boracic acid solution, rub the membrane off of the palpebral conjunctiva, beginning at the border of the lid, and carrying the point of the applicator into the *cul-de-sac* so as to remove the membrane from that position. If the membrane does not come away fairly easily, do not persist too energetically, but let it alone till the following day, when a second attempt may be made. In fact, the membrane will loosen and come away of its own accord after a few days. It is better, however, to facilitate matters if it can be done without injury to the eye.

The use of peroxide of hydrogen, even in the weakest solution, should not be used to remove these membranes, as its use may cause abrasion of the corneal surface, with consequent ulceration and infection of that portion of the eye, a mishap studiously to be avoided. When the disease passes into the purulent stage, it is to be cared for in exactly the same way as is a purulent conjunctivitis.

Diphtheritic Conjunctivitis.

In this variety of membranous conjunctivitis the symptoms are much more severe than in the croupous form just described. The pain is much more intense and the lids are not only swollen and tender to the touch, but are dense and hard, and it is impossible to evert them.

The membrane in this disease is really an infiltration into the conjunctiva, and *cannot be wiped off.* It may affect only small areas of the conjunctiva, but may cover it entirely. The patches of infiltration have a grayish color, but when the entire conjunctiva is involved it assumes a very pale or "lardaceous" appearance, due to the infiltrate pressing on the blood-vessels and diminishing the normal blood supply. It is this very feature of the disease that makes it so dangerous. The cornea depends for its nutrition on the blood from the conjunctiva and subconjunctival vessels, and when the infiltration is very extensive the cornea often sloughs, in part or in whole, despite all efforts to prevent it.

Patches of the conjunctiva may slough away, leaving a granular surface and later scar tissue. The discharge from the eye in this disease is very slight: in the earliest stage of a watery or mucous nature, in the infiltration stage there is practically no discharge, while in the latest stages it may assume a purulent character.

It should ever be borne in mind by the nurse that diphtheritic conjunctivitis is but a local manifestation of a systemic disease. Whenever she notices any membranous patches on the conjunctiva, patches of a similar nature should be looked for in the throat and in the nose, for the throat, nose, and eye are often affected simultaneously.

The general symptoms in this affection are much more severe than in croupous conjunctivitis. The temperature is elevated, the pulse quicker, and the patient markedly depressed. These marked general symptoms, together with the local symptoms of intense pain in the eyeball and stiff, leathery condition of the eyelids should point to the nature of the trouble. In the very early stages of the disease, however, before infiltration of the conjunctiva has occurred

and hardness and stiffness of the lids manifested themselves, it is difficult if not impossible to distinguish the graver from the milder disease. In every instance, therefore, where a nurse has charge of a child, or children, as they often have, and any membranous formation appears on the conjunctiva, it should be reported to the parents or those in authority, and the child in the meantime isolated.

I have dwelt somewhat at length on the symptoms and manifestations of croupous and diphtheritic conjunctivitis, in order that the nurse may recognize or at least suspect the nature of these affections when she comes in contact with them, as she often does.

The protection of the fellow-eye, if but one is affected, the isolation of the patient, and the institution of prompt treatment depend upon the early recognition of the nature of the disease. Only too often is the disease allowed to gain a firm hold and others exposed to the infection before the real nature of the affection is known.

The nurse's first duty in a case of diphtheritic conjunctivitis, after the patient has been isolated, is to apply a protective shield or bandage to the unaffected eye, if but one is involved. The method of doing this has already been described in a preceding chapter, and need not be gone into again here. The second important duty in these cases is the application of hot fomentations. Cold applications should not be applied in diphtheritic conjunctivitis. The vitality of the patient and of the eye is much reduced already, and cold applications make matters worse. Heat, on the other hand, sustains the vitality, and at the same time relieves the pain, and in a measure softens the thickened and stiffened eyelids. Hot saturated boracic acid, or salt solutions, by means of pledgets of eotton soaked in

them, should be applied to the eyes thirty minutes out of every second hour during the day, and half this often during the night. The patient is not disturbed so frequently during the night, in order that he may obtain a sufficient amount of sleep, for it is just as important for the patient to have rest and concentrated diet as local treatment; more so, perhaps. In fact, every measure that sustains vitality, general and local, is to be resorted to. Local remedies or applications, other than the hot fomentations just mentioned, are of but little value in the treatment of this malady. All irritating applications of whatever nature are to be rigidly avoided, as they do harm rather than good. There is but little to be done in the way of cleansing the eye, as in the early and middle stages of the disease there is but scant secretion, and this is from the portion of the conjunctiva not infiltrated. The membrane, or, to be more accurate, the infiltrate, cannot be wiped off and is gotten rid of by absorption. In the later stages of the disease there is more or less of a purulent secretion, and this must be washed away frequently, just as in purulent conjunctivitis, with boracic acid solution. Topical applications of silver nitrate, 10 grains to the ounce solution, may be used sparingly at this stage, being limited to that portion of the conjunctiva not affected by the infiltrate. Where ulceration of the conjunctiva has taken place, the lids should be separated from the eyeball several times a day, and, as this ulceration usually occurs in the later stages of the disease, the lids are usually pliable enough to be lifted away from the eyebal

The membrane may reappear in these cases, especially if irritating applications have been made to the conjunctiva.

Ulceration of the cornea, in part or the whole, frequently occurs in diphtheritic conjunctivitis. At the first

appearance of such a complication, atropine is to be instilled,—of course, according to the surgeon's directions; hot fomentations persisted in, and the general condition of the patient sustained by fluid diet, tonics, etc.

Incidentally, it may be remarked that no cauterization of the corneal ulcer by means of the actual cautery, carbolic acid, nitric acid, or other destructive agents should be undertaken, especially in the early stages, since the ulceration is due to a lowered vitality and cutting off of nutrition to the cornea by the infiltrate, and not to infection. In the later stages such measures may be cautiously used.

Diphtheritic conjunctivitis is met with most frequently in babies after six months of age and young children, though occasionally in the adult. In the latter instance, it is often contracted by doctors, nurses, and attendants, from children suffering with faucial diphtheria, by having the membrane or parts of it coughed into the eye while attempting to cleanse the child's throat. If active measures are at once adopted, usually infection can be prevented, and I have prevented it on one occasion where a doctor had a large piece of membrane coughed direcly into his eye. The eye is cleansed thoroughly with a solution of bichloride of mercury (1 to 5000), then 2 or 3 drops of a 1 per cent. solution of silver nitrate is dropped into the eye, and finally 4 or 5 drops of sweet oil are dropped into the eye.

As to the general care of the patient and nursing connected with faucial diphtheria, the administration of the antitoxins, etc., see the chapter on faucial diphtheria in Part II; also the chapter on Serums and Vaccines.

Traumatic Membranous Conjunctivitis.

This may result from applications of caustics to the conjunctiva, strong solutions of silver nitrate or the solid

stick, carbolic acid, nitric acid, or to dusting the powdered jequirity bean into the eye in the treatment of trachoma, and always occurs after the operation of "expression" of trachoma, if the operation is at all thorough.

Where the membrane is the result of caustics, the only treatment and care necessary is to discontinue the caustic and keep the eye cleansed with boracic acid solution. Sweet oil may be dropped between the lids and the eyes protected with a shade or patch. Care should be taken that no adhesions occur between the lids and the eyeball.

Where the powdered jequirity bean is dusted into the eye, in the treatment of old trachoma with pannus, the eyelids become markedly swollen and edematous, the conjunctiva intensely congested, and the eye very painful in about twelve hours after the powder is put into the eye and lasts from forty-eight to seventy-two hours. Iced cloths are applied fifteen minutes every second hour, and the secretion, which is very scanty, is to be washed away with boracic acid solution. At the end of the second or third day a dirty-grayish membrane is formed covering the entire conjunctiva and even the cornea. This breaks down and comes away a piece at a time, or occasionally a cast of the entire lid is removed. As this membrane loosens it should be washed away with boracic acid solution and rubbed off gently with cotton wrapped on an applicator. Usually the membrane is entirely cleaned away in ten days' to two weeks' time. Iced cloths are not to be used after the pain and intense swelling are gone. The patient is to be put to bed and the eyes looked after as carefully as if the patient had croupous or purulent conjunctivitis.

The membrane that follows "expression" of trachoma is to be treated exactly in the same manner as indicated above. For the first few days after the operation is per-

formed, iced cloths are to be applied; then, when the membrane begins to loosen, it should be washed away or rubbed off with cotton. If this is not done, the membrane organizes, forms dense connective tissue (scar tissue), and leaves the lids in a very undesirable condition, which may result in curving of the lids inward toward the eye (entropion) with the lashes sweeping the cornea.

CHAPTER IV.

SOME OF THE NON-CONTAGIOUS DISEASES OF THE EYE CALLING FOR THE SERVICES OF A NURSE.

Hordeolum—Blepharitis Marginalis—Phlyctenular Conjunctivitis—Ulcerative Keratitis—Iritis—Cyclitis—Irido-cyclitis—Sympathetic Ophthalmia—Glaucoma—Panophthalmitis.

Hordeolum (Stye).

This is one of the commonest affections of the eyes. A stye is not of serious import in itself, but often gives the patient acute pain and much annoyance. It is nothing more or less than a little boil or abscess at the root of an eyelash. Any treatment that aborts the process or alleviates the pain is very grateful to the patient. When seen early, epilation or pulling of the eyelash, at the root of which the abscess is forming, and the application of hot fomentations relieve the pain and frequently abort the disease. If the stye is not aborted, the hot applications should be continued several times a day until the stye is "ripe" for opening, when it should be lanced by the surgeon, the contents gently pressed out with the fingers and hot applications applied a day longer. Where a person is subject to frequent recurrence of styes, the eyes should be examined for glasses, a refractive error sometimes being the exciting cause.

Blepharitis Marginalis.

Inflammation of the borders of the lids is a very common affection of the eyes. It presents itself under two forms: *blepharitis squamosa* and *blepharitis ulcerosa*. In the squamous variety the edges of the lids are reddened and

covered with dry scales; in the ulcerative, the edges of the lids are not only reddened, but the eyelashes are tufted together with dried crusts. When these crusts are removed small ulcers are found beneath them, around the roots of the eyelashes.

If the disease has lasted for a long time it may cause: a chronic conjunctivitis; irregularity of the lashes (wild hairs, or *trichiasis*), causing them to sweep the cornea; total loss of the eyelashes (baldness of the lids, or *madarosis*); thickening of the edges of the lids, and eversion of the lower lid (ectropion).

The exciting causes of the disease are: much weeping; bright light; smoke; dust; closure of the lacrymo-nasal canal, causing tears to run over the eyelids; astigmatism, and excessive use of the eyes. General causes leading to the disease are scrofula, tubercular affections, etc. When only one eye is affected we should look for a local cause, as stopping of the tear-duct.

Treatment.—The local treatment consists, first, in cleansing all scales and crusts from the edges of the lids. This may be done by bathing the lids with a warm solution of carbonate of soda (2 drachms of soda to the pint of water) for ten minutes, rubbing the crusts off with a piece of cotton saturated in the solution. In the very severe cases, where the lids are thickened, the eyelashes should be pulled out with cilia forceps, and the little abscesses at their bases touched with a solution of nitrate of silver (2 per cent.). After the lids are thoroughly cleansed in the manner just described, an ointment of some kind should be rubbed on the edges of the closed lids. Of the various ointments, the yellow oxide of mercury (Pagenstecher), ½ to 1 per cent. (the base of vaselin or lanolin), perhaps is the best. In very sensitive eyes the ammoniated mercury

ointment, the same strength as the yellow oxide, may be used. As a base for these ointments, equal parts of vaselin and lanolin are to be preferred. In obstinate cases the red oxide of mercury ointment and tar preparations may be used, but they are usually too irritating. As a rule, the milder the ointment, the less irritation and the quicker the cure. In these mercurial ointments, too, it is altogether essential that they be well made, the mercury finely pulverized, and no grains left in it. A few drops of sweet oil added to the powdered mercury and rubbed with it before it is added to the base facilitates this and makes a smoother ointment. No more than ½ ounce of ointment should be prescribed at one time, as it soon becomes rancid, when it should be renewed.

The general treatment consists of placing the patient in better hygienic surroundings, which unfortunately can seldom be done, as usually the patients are from the poorer classes; building up the system with tonics, as the syrup of the iodide of iron, syrup of hypophosphites, codliver-oil, etc.; and placing the patient on a simple nutritious diet.—milk, bread and butter, oatmeal, fresh meat once a day, eggs, etc. All sweets and pastry should be excluded from the diet.

Phlyctenular or Lymphatic Conjunctivitis.

Phlyctenular keratitis may be discussed under this heading also, as it is essentially the same disease, the conjunctival epithelium extending over the cornea and forming its anterior layer, the one chiefly affected in this disease.

The disease occurs most frequently in young children and up to puberty—rarely before 1 year of age or in adults. Children in poor hygienic surroundings with inadequate nourishment and scrofulous and tubercular taint are most

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subject to it. Unlike the other forms of inflammation of the conjunctiva, which are diffuse in character, this affection is circumscribed, or focal, in nature; that is, small spots of the conjunctiva or cornea are affected while the rest remains in a quiet state.

The favorite location of these phlyctenules is at the *limbus* of the conjunctiva; that is, where the conjunctival epithelium incroaches upon the cornea. From one to a half dozen small, red, somewhat elevated spots, about the size of a pinhead (sometimes larger, sometimes smaller), appear on or near the limbus of the conjunctiva. Small leashes of blood-vessels, triangular in shape, run to each phlyctenule, or rather nodule, as there is, in fact, no vesicle, but simply an elevation of the epithelium by an exudate of round cells beneath the epithelium. After a few days' time (from one to three) the epithelium at the top of the elevation breaks down, leaving a small, grayish ulcer. This heals under favorable conditions in from one to two weeks' time. The same holds true when they are on the cornea, and without leaving opacities. When neglected and the ulcer extends into the true corneal tissue, opacities are left which never clear away, and the sight is impaired. Sometimes these small ulcers take on a serpiginous character; that is, extend across the cornea, drawing a leash of blood-vessels after them, and leaving a bandlike opacity when they heal. Phlyctenulæ may appear on the conjunctiva (ocular) alone, when they are large and usually few in number; they may appear on the cornea proper, or at the limbus of conjunctiva, as they do most frequently. They may be very small and surround the cornea entirely.

The most marked symptoms of phlyctenular conjunctivitis, outside of the phlyctenules themselves, is the great fear of light (photophobia) which is present in almost

every case; and, second, the spasm of the orbicular or lid muscles. Children will hide their faces in dark corners, in the bedclothes to avoid the light, and they shut the eyelids tightly for the same reason and on account of the irritation of the cornea and conjunctiva. Often accompanying this disease the edges of the eyelids are inflamed, and even the outer surface of the lower lid and the nasal mucous membrane and the upper lip have an eczematous eruption, which must be treated along with the eye affection.

Treatment.—Locally, the best and most frequently used remedy is the Pagenstecher ointment of the yellow oxide of mercury (1 to 2 per cent.), which is placed on the everted lower lid with a small spatula or with the tip of the finger, then the lid is allowed to close and the ointment is rubbed into the eye with the tip of the finger over the closed lids. This is done once a day. Calomel dusted into the eye once a day with a camel's-hair brush is another favorite remedy in these cases. If there is marked inflammation of the eyes and the ulcers are rather deep, it is better to treat the eyes for a few days with atropine and hot water fomentations until the inflammation is reduced somewhat, when the above remedies may be applied. The eruption on the outer surface of the lids and about the nose is treated by having the scales washed off and the yellow oxide of mercury salve rubbed on the affected surfaces. Painting the surface about the nose with a solution of nitrate of silver (10 grains to the ounce) often is of great benefit.

For relief of the spasm of the lids and to make the patient open the eyes, dipping the face into a basin of cold water three or four times a day is the best remedy. Small children are wrapped in a towel or sheet, held under one arm, and their faces pushed into the water and held there

ten to twenty seconds with the other hand. Usually the child holds the eyes open for an hour or two after this ducking. If the photophobia is intense, a solution of sulphate of escrin (½ grain to the ounce) may be used twice a day, and dark glasses or a shade worn. Under no circumstances should the child be allowed to hide in dark corners or its face in the bedclothes.

General treatment consists in building the patient up with tonics, as the syrup of iodide of iron, syrup hypophosphite compound, codliver-oil, etc.; placing the patient in the best hygienic surroundings; and, when it is possible, getting the patient into the open air two or three hours a day. The food should be simple; milk, bread and butter, soups, eggs, fresh meat once a day, etc., while all sweets are discontinued.

The eyes of these patients usually get well in from one to four or five weeks' time, but unfortunately there is a marked tendency to recurrence of the disease, and, when once affected, the patient is liable to fresh attacks until puberty is reached, and exceptionally even later in life. The sight may be greatly impaired if many attacks occur or if treatment is neglected.

Ulcerative Keratitis.

Three of the severer types of ulceration of the cornea will be spoken of here; in particular, *serpiginous ulcer* (*ulcus serpens*); perforating ulcer; and the rodent ulcer (*ulcus rodens*). The subjective symptoms of ulceration of the cornea are: pain, fear of light, tearing of the eyes, closing of the lids to keep the light out, and more or less interference with vision. Objectively, in the early stage of ulceration, a facet, smaller or larger as the case may be, is seen on the cornea. If the ulcer is a clean one, the bottom

and edges of the facet are very slightly grayish and there is but slight infiltration of the neighboring cornea. If it is a foul ulcer, the bottom and edges of the ulcer are covered with grayish matter, and the cornea next the ulcer is infiltrated and of a grayish color. Sometimes pus forms in the anterior chamber, which is called hypopyon. Usually there is an iritis present when this complication happens, with intense pain and circumcorneal injection.

In *serpiginous ulceration* of the cornea the ulcer is clean on one side and dirty or foul on the other. On the clean side (which is nearest the periphery of the cornea) blood-vessels are thrown out to it from the corneal limbus and it heals; while on the other side the grayish infiltrate keeps extending into the cornea, the corneal tissue breaking down (ulcerates), and this ulceration may creep or extend entirely across the cornea. The blood-vessels which are thrown out to the clean side of the ulcer follow in the wake of the ulcers and heal it. When the ulcer finally heals, a band or ribbonlike opacity is left, which, though it may not extend deep into the corneal surface, often impairs vision very much on account of its extent.

Rodent ulcer of the cornea affects the superficial layers of the cornea and is marked by severe inflammatory symptoms. It usually starts at or near the margin of the cornea with edges that are undermined and of a dirty-grayish color. This undermining and breaking down of the rim of cornea immediately surrounding the ulcer progresses interruptedly (for often the edges of the ulcer clear up as if healing were about to take place, and then it starts again) until frequently the entire surface of the cornea is affected. A diffuse opacity covering the entire cornea results and useful vision is destroyed. Unfortunately both eyes may become affected. The disease occurs in old people.

Treatment.—*Local* treatment consists in protecting the eyes from bright light, the instillation of atropine, the application of hot fomentations, and, chiefly and most efficient, cauterization of the ulcer by the surgeon with the actual cautery, the galvanocautery, or with pure carbolic or nitric acid. In ulcus serpens the foul side of the ulcer only should be cauterized.

The *general* treatment is directed to toning the patient up with tonics, concentrated fluid diet, rest, massage, and, what often proves of marked benefit in these cases, a series of hot baths. Care should be exercised in giving hot baths, especially if the patient has a weak heart. The bowels should be kept in order.

Perforating Ulcer.—Ulceration of the cornea following violent inflammation of the conjunctiva, as after gonorrheal ophthalmia, diphtheritic ophthalmia, etc., often results in perforation of the cornea with prolapse of the iris into the wound, and sometimes with entire destruction of the cornea with loss of the lens and vitreous, and followed at times even with panophthalmitis. Perforating ulcer of the cornea is a serious disease, the iris often falling forward into the opening, becoming adherent, and when the wound heals leaves a dense, white opacity (leucoma) interfering greatly with vision. Sometimes this leucoma is so thinned that it bulges forward, forming a staphyloma of the cornea. When hypopyon complicates ulceration of the cornea and is not resorbed quickly, paracentesis of the cornea should be practised and the pus evacuated; because, if allowed to organize, it blocks the pupil and may bind the cornea to the iris, and does great damage to vision and the eyeball in this way. The nurse is required to apply hot fomentations (moist) thirty minutes out of every two hours, and the instillation of a mydriatic as directed. Often

a bandage is indicated, when it has to be changed frequently to allow the application of hot water. The general condition of the patient and the giving of baths all come under the nurse's immediate direction.

Iritis, Cyclitis, Irido-cyclitis, Sympathetic Ophthalmia.

Iritis is an inflammation of the iris; cyclitis is an inflammation of the ciliary body (ciliary muscle and processes), while irido-cyclitis is an inflammation of both the iris and ciliary body. Irido-cyclitis, when transferred from one eye to the other, as after an injury to the one eye, is called sympathetic ophthalmia. Iritis, cyclitis, and irido-cyclitis may be primary or secondary in nature. When primary, they are usually due to some general disease, as syphilis (acquired), rheumatism, infectious diseases, etc.; or they may be due to traumatism, and the second eye may be affected sympathetically. When of a secondary nature, they most commonly follow inflammations of the cornea.

IRITIS.

The objective symptoms of iritis of the plastic or exudative type (following syphilis, and about 65 per cent. or more of all cases are such) are: (1) discoloration of the iris, in blue eyes to a greenish or greenish-yellow hue, and in dark eyes to a "muddy" or lighter brown, as compared with the fellow-eye; (2) at times yellowish-red nodules appear on the borders of the iris, 1 to 4 or 5 millimeters in diameter, and varying in number from one to a half dozen or more; (3) contraction of the pupil and immobility of the iris; (4) redness of the eyeball, especially that part of it immediately back of the cornea; (5) cloudiness of the

aqueous humor and, at times, in severe cases, the presence of pus in quantity in the anterior chamber (hypopyon); (6) a gray exudate filling the pupil (occlusion of the pupil); (7) impairment of vision; (8) lacrymation. Exudates may be formed on the posterior surface of the iris binding it to the anterior surface of the lens capsule, which are called posterior synechiæ. If these synechiæ bind the entire pupillary margin to the lens capsule (seclusion of the pupil) it is called posterior annular synechiæ. This is seen only in the latest stages of the disease, and manifests itself by a "ballooning" of the iris; that is, the pupillary margin of the iris being bound to the lens capsule, the secretions back of the iris, being unable to escape into the anterior chamber, push the middle zone of the iris forward.

The subjective symptoms of iritis are: (1) pain in the eye, as a rule most severe at night; (2) photophobia (fear of light); (3) pain in the temple and side of the head on the corresponding side as the affected eye.

CYCLITIS.

Cyclitis without a complicating iritis, except in a chronic form (described as serous iritis), is a rare affection. The symptoms of inflammation are very mild; the pupil is dilated, the anterior chamber is deep, the aqueous humor is a little hazy, and often there is a deposit of small, grayish spots on the posterior surface of the cornea, and at times the eye has a plus tension.

IRIDO-CYCLITIS.

Irido-cyclitis, being an inflammation of the iris and the ciliary body, has the symptoms of an iritis, which have been enumerated above, and, in addition, the following symptoms may be present: (1) edema of the upper lids;

(2) excessive tenderness of the eye to the touch, especially over the ciliary region; (3) excruciating pain, which may be attended in severe cases with vomiting and elevation of temperature; (4) marked disturbance of vision, due to opacities in the vitreous and deposits on the posterior surface of the cornea; (5) increased depth of the anterior chamber due to binding down of the entire posterior surface of the iris to the lens capsule; (6) increased tension of the eye, followed in the latest stages of the disease by diminished tension.

SYMPATHETIC OPHTHALMIA.

This disease, irido-cyclitis, may be transferred from one eye to the other (especially if it is due to a traumatism), when it is called *sympathetic ophthalmia,* or *sympathetic irido-choroiditis.* Sympathetic ophthalmia is a very serious disease of the eye, and when once thoroughly established rarely subsides until the sight of the sympathizing eye is entirely destroyed. It follows most frequently an irido-cyclitis which has been produced in the injured eye by a penetrating wound of the ciliary region or by a foreign body being lodged in the eye. The disease may appear as early as the second week, but usually not until from four to six weeks after the injury to the offending eye, when the inflammation in the injured eye is at its height. It may appear, however, years after the injury, especially when foreign bodies have been lodged in the eye. These may become loosened, set up a fresh inflammation of the injured eye, and a sympathetic inflammation in the other. No wound in the ciliary region of an eye, or a foreign body lodged in an eye, is to be regarded as free from inciting sympathetic ophthalmia in the fellow-eye, even years after the traumatism has occurred.

Sympathetic ophthalmia is characterized by a prodromal stage and by its marked tendency to recur. Failure of the power of accommodation (in the sympathizing eye) is one of the very first signs of the disease. The patient, though he may be a young subject, finds he has to hold reading matter farther from his eyes than usual in order to read; secondly, the eye becomes sensitive to light or even painful; thirdly, there is lacrymation; and finally some redness of the eye. This is termed *sympathetic irritation*.

As a rule, unless this condition is speedily relieved by quieting the inflammation in the injured eye, it develops into an irido-choroiditis, marked by circumcorneal injection, contraction of the pupil, clouded aqueous humor, but rarely with hypopyon; there are also pain, photophobia, and retraction of the iris in severe cases. This condition may last from two to several weeks, and then subside, but almost without exception the attack is repeated and repeated until the sight is totally destroyed. In fact, if the sight is not entirely destroyed in the injured eye, it may retain more vision than the sympathizing eye. The surest method of preventing sympathetic inflammation is to enucleate the injured eye before the inflammation is well established in the uninjured eye; that is, when the symptoms of sympathetic irritation set in; for when once fully developed enucleation of the injured eye rarely relieves it.

THE TREATMENT OF IRITIS, IRIDO-CYCLITIS, AND SYMPATHETIC IRIDO-CYCLITIS.—In iritis the first and most important step in treatment is to dilate the pupil, if that can be done. A solution of the sulphate of atropine (varying in strength from 1 to 3 per cent.) is the drug most relied upon. A drop of the solution, usually 1 per cent., should be put into the eye every five minutes, extending over a period of thirty minutes. If the pupil does not dilate

easily, a drop of cocaine solution (1 per cent.) should be dropped into the eye along with the atropine, or a few drops of adrenalin chloride solution (1 to 1000) may be supplemented. The cocaine and adrenalin solutions (and atropine to a slight extent) aid in the dilatation of the pupil by contracting the blood-vessels of the iris and driving the blood from it. In stubborn cases where the adhesions are firm, Fuchs advises dropping a small granule of atropine in substance in the conjunctival sac.

A powerful cycloplegic of comparatively recent use is scopolamine, which is to be used in the same manner as the atropine, but in much weaker solution: from $\frac{1}{10}$ to $\frac{1}{5}$ of 1 per cent. solution. The nurse should always be careful to press with her fingers on the lacrymal sac at the inner corner of the eye for two or three minutes after instilling a mydriatic or myotic into the eye, to prevent an excess of the drug going into the nose, where by rapid absorption into the general system it may cause annoying and sometimes alarming symptoms of poisoning. The patient also should be shown how to press over the inner corner of the eyes to prevent the above complication.

If the pupil does not dilate by the use of these methods, from two to six leeches should be applied to the temple on the side of the affected eye (for the method of applying leeches see page 90), or the artificial leech may be used. If the pupil still does not yield, a hypodermic injection of the muriate of pilocarpine ($\frac{1}{10}$ to $\frac{1}{5}$ grain) causes profuse sweating and often aids in dilating the pupil. Hot, moist compresses to the eye and hot baths also assist in dilating the pupil, as well as alleviating the pain, as does also the leeching. In fact, the nurse's chief duty after instilling the medicines into the eye will be the application of hot fomentations. These should be kept up thirty minutes out of

every two hours during the day and half as often during the night if there is much pain.

The eyes (both) should be shaded from light with a light patch or shade, or dark glasses, or the room should be darkened.

After the pupil is once dilated atropine should be used once or twice a day to keep it dilated. The bowels should be kept open. The diet should be light, no liquors being used, and in severe cases the patient should be confined to bed. In fact, in iritis of any severity the patient is much better off in bed than out, and the disease runs a quicker course.

The general treatment is directed to removing the cause. In syphilitic iritis the inunctions of mercury are begun at once, using the oleate of mercury (20 per cent., Squibbs), ½ to 1 drachm being rubbed into the patient every night by the nurse with rubber gloves. This should be continued until the iritis subsides. Care should be taken not to salivate the patient. Potassium iodide in saturated solution may be given at the same time, the dose being increased from 5 drops, 1 drop a dose, until the effect of the medicine is manifested by watering of the eyes, and small pimples on the face, when the dose should be lessened. It should be given in a full glass of water or milk after meals.

In rheumatic iritis the salicylates are given and hot baths resorted to.

The treatment of irido-cyclitis is much the same as that of iritis. Mydriatics are not so well borne sometimes, especially if there is elevation of the tension. In sympathetic irido-cyclitis the best treatment is prevention, and the best prevention is early enucleation of the injured eye before actual inflammation starts in the uninjured eye. Once started, no treatment is of much avail, though mer-

cury in full doses and sweating by means of pilocarpine injections may prove of benefit. Very large doses of salicylate of soda has been recommended in these cases, and favorable results reported (Gifford).

Glaucoma.

A brief description of acute and inflammatory glaucoma is given here that the nurse may not confuse this disease with iritis, and that she may not make the great mistake of instilling atropine into eyes affected with this disease.

Glaucoma is a complex disease of the eye, characterized by *hardening* of the eyeball, from which hardening or elevation of tension (plus tension) all the other symptoms of glaucoma follow. It may be primary in nature, or secondary following injury or disease of the eyeball. In the former case it affects both eyes always, but not necessarily at the same time, while in secondary glaucoma but one eye is affected.

In primary glaucoma there is usually a prodromal stage, which may extend over days, weeks, months, or even years before the disease manifests itself in virulent form. During this stage the patient has attacks of dimness of vision, sees rings round lights, rainbow colored, and has a sense of fullness in the eye extending often to the forehead and temple. The pupil is slightly dilated and sluggish, the tension of the eye is elevated (plus), and there is slight redness of the eyeball. These attacks may last for hours, completely disappear, and not return again for months perhaps. The eye in the meantime resumes the normal condition. Then the attacks become more frequent, last longer, and finally develop into a full-fledged inflammatory glaucoma. The eyeball becomes intensely hard to the touch of

the finger through the closed lid, feeling like a stone; the eyeball is dusky red in color, with marked edema of the conjunctiva often extending to the eyelids; the pupil is widely dilated and does not react; there is a greenish reflex from the pupil; the cornea has a steamed appearance and is insensitive to touch; the anterior chamber is very shallow, while the pain is unbearable. Pain extends to the temple and head, and is of the intense neuralgic type, the patient often mistaking the disease for neuralgia. At times there is rise of temperature and vomiting. The field of vision is much contracted and the sight greatly reduced, and may be totally destroyed in a few hours' time in the worst cases. Such an attack may last for days or weeks, when the eye becomes quiet, the pain and redness disappear, and the tension much reduced if not entirely normal. If active treatment is not instituted, as eserin in oily solution (2 grains to the ounce) or pilocarpine solution (4 grains to the ounce) instilled, or iridectomy performed, the attacks recur and the eyesight is slowly, but surely, destroyed. It is altogether important that this disease be not mistaken for iritis and atropine instilled, as is frequently done (even by doctors) to the great detriment of the eye. Dilatation of the pupil blocks the canal of Schlemm and increases the trouble.

The important points of differentiation between glaucoma and iritis are as follows: 1. In glaucoma the *tension* is increased and the eyeball is hard. In order to detect hardness of the eye, palpate the eyeball over the closed lids with the tip of the index finger of each hand; then palpate the unaffected eye, and any difference in tension of the two is apparent. In iritis the *tension* is normal. 2. In glaucoma the *pupil is dilated;* in iritis the *pupil is contracted*. These two points of differentiation should be well fixed in the mind of the nurse.

The cause of primary glaucoma is little understood. Some (von Graefe) attribute it to increased fluid in the eye, some (Donders) to irritation of the ciliary nerves, some (Stellwag) to increased blood-pressure in the blood-vessels inside the eye, while others (Weber and Knies) to diminished outflow of fluid from the eye.

Predisposing causes are: old age, hardening of the blood-vessels, obstinate constipation, sudden increase of blood-pressure; while women are more frequent sufferers than men. The form of the eye itself seems to have some effect, as myopic eyes are seldom attacked by glaucoma, while the flat hypermetropic eye is.

Treatment.—When seen early the instillation of eserin solution (2 grains to 1 ounce of sweet oil), 1 drop every ten minutes for an hour, may prevent an acute attack, or, if at its height, may reduce the tension, relieve pain, and leave the eye in better condition for performing iridectomy. Iridectomy has proved to be the quickest and surest relief and even cure of this frightful disease.

Panophthalmitis.

As the name indicates, panophthalmitis is an inflammation involving all the tissues of the eyeball, and even the cellular tissue of the orbit and the lids are involved. The disease originates usually from an acute traumatic purulent choroiditis, or retino-choroiditis; or it may follow a perforating ulcer of the cornea. It may be metastatic in nature, following pyemia, measles, scarlet fever, diphtheria, influenza, small-pox, meningitis, etc., when it may affect both eyes.

The two most prominent symptoms are: (1) intense pain; (2) marked swelling of the eyeball, the tissues of the orbit and lids participating in the process. After the first

few hours the pain becomes unbearable, unless relieved by hot fomentations, opiates, or lancing of the eyeball. The pain radiates to the head and is often accompanied by rise of temperature and vomiting. The eyeball becomes prominent; the conjunctiva intensely congested, edematous, and a purplish red; the cornea hazy; the anterior chamber filled with pus; and the lids swollen and red, and tender to the touch.

The nurse's duty in such cases is the application almost continuously of hot fomentations, either in the form of linseed poultices or hot, moist applications (water 115° F.) by means of pledgets of cotton.

When the eyeball has perforated or has been split open by the surgeon the wound should be syringed every two hours with a solution of bichloride of mercury (1 to 2000) or of carbolic acid (1 to 150), seeing that the solution gets inside the eyeball. The pain usually subsides quickly after the eyeball is once opened.

The general condition of the patient is to be carefully looked after by the nurse, and the pulse, temperature, bowel movements, etc., charted.

The prognosis is always unfavorable in panophthalmitis: the eyeball shrinks and the sight is totally lost. The disease is due to infection, and various micro-organisms have been found by microscopical examinations, as the staphylococcus aureus and albus and the streptococcus pyogenes.

CHAPTER V.

REMEDIES AND THEIR APPLICATION.

Antiseptics—Astringents—Anodynes—Irritants—Counter-irritants—Caustics—Galvanocautery—Actual Cautery—Cycloplegics, Mydriatics, and Myotics—Anesthetics—Miscellaneous Remedies—Vehicles—Bases—Solutions—Ointments—Powders.

THE nurse should be familiar with the various remedies and measures used in the treatment of eye diseases and have some knowledge of the nature of their actions, for in this way only will she be able to apply them intelligently.

ANTISEPTICS.

Antiseptics are a class of remedies used for the prevention of septic decomposition or inflammation, or for arresting the process if already begun. Their efficiency depends upon their power to kill the micro-organisms which cause the inflammation.

Boracic acid is a mild astringent powder. It is slightly antiseptic in action and causes no irritation whatever to the eye. It is used in a solution of from 1 to 4 per cent. for cleansing and irrigating the eyes in the various inflammatory affections. For this purpose it has almost superseded all other solutions, and, although only mildly antiseptic in action, on account of its unirritating property, it is used largely for irrigating the eye just before operations on that organ. After the eyeball has been opened, as in cataract extraction, iridectomy, etc., it is to be used in preference to all other solutions. An equal amount of borax added to it makes it more soluble. It is sometimes used in the form of an ointment (10 per cent.), and is valuable in the

various inflammations of the conjunctiva and cornea. In solution it is often used as a vehicle for eye drops and in the preparation of surgical dressings which are dipped into it and then dried.

Carbolic Acid.—This is used in very weak solutions (½ per cent.), as it is irritating to the eye when first applied. It is used chiefly for cleansing the eye and for its antiseptic properties in septic cases. The pure phenol, and not the commercial form, should be used in making the solution, as it is less irritating. Carbolic acid may be applied in the form of an ointment (2 to 5 grains to the ounce) to rub between the inflamed lids of the eye. In a strength of 1 to 20, the solution is often used for disinfecting instruments by immersing the instruments in it for five or ten minutes.

Mercuric bichloride is one of the best antiseptics we have. It has a limited use about the eye, however, as it is highly irritating when used in sufficient strength to be germicidal in action. It has the further disadvantage of being a poison and of coagulating the albumin in the tissue, thus limiting its action to the surface of the tissue. For cleansing and irrigating the eye, it is used in solution of 1 to 10,000 and 1 to 5000, but never stronger than 1 to 3000. In the latter strength it is highly irritating. When cocaine is dropped into the eye, as for cataract operation, and then the eye irrigated even with 1 to 5000 bichloride of mercury solution, haziness of the cornea is produced and permanent opacities may result. The solution is not to be recommended in such cases. Simple sterilized water or boracic acid solution is much to be preferred. In the form of an ointment, 1 to 5000 (vaseline as a base), bichloride is often used for its antiseptic properties. In the treatment of trachoma a solution of 1 to 500 or even 1 to 250 is at

times applied on the everted lids. It should be strictly limited to the lid, however, and no excess allowed to run on the eyeball. For disinfecting the hands a solution of 1 to 1000 may be used, the hands being immersed for two or three minutes in the solution. On account of its corrosive action it is never used on instruments. Surgical dressings of gauze, dipped into a solution 1 to 5000 or 1 to 3000 of bichloride of mercury, then dried and prepared, are sometimes used about the eye. As a rule, however, simple sterilized dressings are the best for the eye.

Biniodide of mercury, in very weak solution, is sometimes used for irrigating and cleansing the eye. The late Professor Panas used a solution of 1 part of biniodide of mercury, 4 parts of alcohol, and 20,000 parts of water for cleansing the eyes before operating. Its efficiency in such weak solution has been doubted and its chemical compatibility questioned, since what little mercury is present is precipitated, it is claimed.

Oxycyanide of mercury, in solution of 1 to 500 or 1 to 1000, has decided antiseptic properties and is less irritating to the eye than the bichloride of mercury. It has the further advantage of not injuring instruments when they are dipped into it.

Calomel, dusted into the eye, acts as an irritant and antiseptic, probably by being changed into the bichloride of mercury by the action of the salt tears.

Potassium permanganate, in solution of 1 to 500 to 1 to 100, is a strongly antiseptic agent of a purplish hue, which is somewhat irritating to the eye when used in strong solution. On account of its staining properties it is more or less objectionable.

Formalin contains about 35 per cent. of formic aldehyde. In solution of 1 to 5000 to 1 to 2000 it is astringent,

irritant, and strongly antiseptic in action. It has highly preservative properties. In the weaker solution it is used to cleanse and disinfect the eye before operations, but should not be used in those cases where the eye is to be opened, as in cataract operations, as it is too irritating and causes too much congestion of the parts. In the stronger solutions, 1 to 2000, it is used as a cleansing solution and as an application to the lids of the eye in the contagious inflammatory diseases.

Formaldehyde, in solution 1 to 3000 to 1 to 1000, is strongly antiseptic, but very irritating to the mucous membranes, and for that reason is seldom used about the eye.

Chlorine water, the official, which contains $\frac{3}{10}$ of 1 per cent. of chlorine gas, is astringent and antiseptic in action, and where used in dilution of 3 drachms to the pint of water is but slightly irritating to the eye. It is used for cleansing the eye before operations and also in the acute contagious inflammatory diseases. The solution rapidly deteriorates, and for that reason must be freshly prepared and kept away from the light in a dark-colored, glass-stoppered bottle.

Hydrogen peroxide, in 3 per cent. solution (the usual strength as it comes in the original bottle), is a strong antiseptic, being both germicidal and disinfectant in its action. It may be used in full strength, or, if too irritating, may be diluted one-half, when it may be used freely in the eye, provided there is no ulceration of the cornea, when it should be used with great caution and its action limited to the lids by being applied with probe and cotton. For removing the membrane from the lids that follows the operation of "expression" for trachoma, and for cleansing and disinfecting the eye occasionally in purulent inflammation of the conjunctiva, it is an excellent preparation. It should not be

used too frequently, however, for cleansing the eye, as it becomes an irritant. When it comes in contact with pus or blood it breaks up the corpuscles through oxidation and causes a froth or foam. This foam should always be washed away with boracic acid solution or plain, sterilized water. As the solution quickly deteriorates it should be kept in a glass-stoppered bottle and in a cool place.

The preparation known as *pyrozone* (3 per cent. solution) is less acid than some other preparations of peroxide of hydrogen on the market, and for that reason is recommended in the eye, as it is less irritating than the others.

Pyoktanin (pus-killer), or *methyl violet,* in solution of 1 to 5000 to 1 to 2000, is antiseptic and unirritating in action. On account of its staining properties it has never had wide use. Stilling recommended it a few years ago, and it has been used in purulent conditions of the conjunctiva for cleaning and disinfecting, but its use is almost wholly given up now.

Iodoform is but slightly antiseptic in its action. It is highly offensive in odor. It and its substitutes, aristol, iodol, etc. (which latter have not the offensive odor of the former), are used chiefly in dressing wounds. They may be dusted on the wound or applied in the form of an ointment (10 per cent.). Corneal ulcers requiring stimulation are sometimes dusted over with iodoform with benefit. Gauze impregnated with iodoform (10 per cent.) is much used as a dressing for wounds.

Zinc chloride, in weak solution (1 to 1000 to 1 to 300), is antiseptic, astringent, and stimulating in its action. It is seldom used for irrigation of the conjunctiva because of its irritating properties. In ½ to 1 per cent. solution it is frequently used as an application to the lids in chronic inflammation.

Lysol is a tar-oil dissolved in fat and then saponified with alcohol. It is antiseptic, disinfectant, and deodorant in action. In a 1 to 2 per cent. solution it is excellent for cleansing the field of operation, hands, and instruments.

Chinosol, in solution of 1 to 3000 to 1 to 2000, is mildly antiseptic in action, and is used for cleansing the conjunctiva.

ASTRINGENTS.

Many of the antiseptics are also astringent in action. This class of remedies contracts the blood-vessels and tissues (especially mucous surfaces) when brought in contact with them. In this way the blood supply to the part is lessened and the secretions from mucous membranes diminished, partly by depleting the tissue of blood and partly by coagulating the albumin in the tissue.

Silver Nitrate.—Of all the astringents used about the eye, nitrate of silver is the most efficient and the one most commonly employed. It is not only strongly astringent, but when used in strong solution or in solid form acts as a caustic. It is also a valuable antiseptic and germicide, and is often employed in the acute contagious diseases of the eye. Acting in its double capacity of astringent and germicide, it is the most valuable remedy we have in such affections. Solutions of the drug are soon decomposed and rendered inert when left exposed to light; hence they should be kept in dark-colored bottles, and, when not in use, in a dark place. The strength of the solutions used varies from 5 to 20 grains to the ounce, exceptionally 40 to 60 grains to the ounce, for astringent and antiseptic purposes. Solutions stronger than this are used for their caustic action. When brought in contact with mucous surfaces silver nitrate coagulates albumin and forms an insoluble precipitate which renders its action superficial. For this reason it

must be reapplied to the conjunctiva, in the acute microbic diseases of that membrane, especially in gonorrheal ophthalmia, every twenty-four to forty-eight hours, according to the severity of the reaction, in order to kill the fresh supply of micro-organisms which appear on the surface from the deeper tissues. Solutions of nitrate of silver of 5 to 10 grains to the ounce may be dropped into the eye without harm, unless there is ulceration of the cornea. Where there is ulceration of the cornea a precipitate of silver may form an opacity at the site of the ulcer. Credé's method of preventing ophthalmia neonatorum in the lying-in hospital at Leipzig was to drop 1 or 2 drops of a 10-grain to the ounce solution of silver nitrate into the eyes of all infants immediately after birth. In this way he reduced the percentage of such cases enormously. In solution stronger than 10 grains to the ounce silver nitrate should always be applied to the everted lids by means of cotton on a probe, and the excess immediately washed away with a salt water solution. In stick form, or strong solution, silver nitrate is used to remove granulation tissue, polypi at the base of ulcers on the lids, etc. It may be fused with other drugs, as nitrate of potassium, and used as a caustic. The solutions of silver nitrate when used for too long a time on the conjunctiva cause it to turn to a slate color (argyria). This point should be borne in mind.

Silver Substitutes.—Various substitutes for silver nitrate have been tried in the last few years. They contain a certain percentage of silver nitrate, are organic in composition, but little irritating, and do not coagulate albumin, and for this latter reason are supposed to penetrate deeper into the tissues. They are germicidal and astringent in their action also. The most valuable one of these preparations and the one containing the largest percentage of silver

(30 per cent.) is *argyrol* (silver vitellin, Barnes & Hille). It is especially useful in the acute contagious diseases of the conjunctiva, and is used in solution varying from 25 to 250 grains to the ounce. *Protargol* contains about 8 per cent. of silver, is more irritating than argyrol, and is used for the same purpose, in solutions varying in strength from 5 to 30 grains to the ounce. *Argentamine* contains about 10 per cent. of silver, and is a slightly irritating astringent, and antimicrobic in action. It may be used in a 5- to 25- grain to the ounce solution. *Argonin* may be used in solution of from 5 to 30 grains to the ounce, and in the same cases as argentamine. *Aktol* (lactate of silver) and *collargol* (argentum colloidale, Credé) are used in solutions for disinfecting the conjunctiva. *Itrol* (citrate of silver) is used in the form of a dusting powder for infected wounds and in the contagious diseases of the eye. It is non-irritating and is to be applied from an insufflator, so as to drive the substance into the affected tissues (Meyer).

Alum.—The sulphate of alum in crystal form, shaped into a pencil or stick, is frequently used in the milder inflammations of the lids. It acts as an astringent and exsiccant and coagulates albumin. At times it is used in solution (1 per cent., as alum curd) in relaxed conditions of the conjunctiva.

Alumnol, a preparation of aluminum (naphthol disulphonate), is mildly astringent and sedative in action; most commonly it is used in powder form, 1 part of alumnol to 5 or 10 parts of boracic acid, bismuth, or talcum, to dust over wounds. It is soluble in water and may be used in solution (5 per cent.) for irrigation.

Acetic acid, in solution (3 per cent.), acts as a mild astringent and sedative and is occasionally used in mild inflammations of the conjunctiva. In case of lime burn of

the eye, especially when seen early, it is most useful, acting as a chemical antidote. Weak solutions of vinegar may be used for the same purpose.

Tannic acid, in solution (1 to 20 per cent.), is markedly astringent and tonic in action on mucous membranes, is slightly irritant in weak solution, moderately so in strong solution, and coagulates albumin. It is one of the most frequently used drugs in inflammatory conditions of the conjunctiva. It is often used in the form of the aqueous solution (Agnew):—

℞ Acidi tannici,
Sodii biborati .... āā gr. x.
Glycerini .... ʒj.
Aquæ camph. .... ℥j.
M. et ft. sol.
Sig.: Two drops in each eye three times a day.

This solution is extensively prescribed at the Manhattan Eye and Ear Hospital, New York. In the treatment of trachoma, in which it is very beneficial, tannic acid may be used in from 2 to 8 per cent. solution of camphor water, to which 1 drachm of glycerin is added. The old preparation of *glycerole of tannin* (120 grains of tannin to 1 ounce of glycerin) is rarely used now, as tannin is much more irritating in pure glycerin as a vehicle than when mixed with camphor water.

Zinc sulphate, in solution (1 to 2 per cent.), acts as an astringent. In the stronger solutions it is applied to the conjunctiva with probe and cotton. If dropped into the eye it should not be stronger than 1 to 3 grains to the ounce of water. The strong solutions act as mild caustics.

Zinc oxide is used most frequently in an ointment (20 per cent.) with benzoinate of lard as a base. It is mildly astringent and sedative in action. The dry powder is some-

times used in place of the ointment. Oxide of zinc is used chiefly in eczematous conditions of the lids, being both soothing and protective in action.

Copper sulphate, in weak solution (1/5 to 1/2 per cent.), may be used as a stimulating tonic in chronic inflammation of the conjunctiva, as in trachoma.

Lead subacetate (*liquor plumbi subacetatis*) acts as a mild astringent and sedative; in a weak aqueous solution it was formerly used frequently as a wash (1 to 2 per cent.) for the eyes, but, on account of its causing dense white opacities on the cornea when the least abrasion or ulcer on that membrane was present, its use has been almost entirely abandoned, and wisely so.

Suprarenal extract and its derivatives act as pure astringents and hemostatics, with but little irritation or reaction following. They are all used in solution, and where dropped into the eye cause marked blanching of the mucous surface in from one to two minutes' time. This lasts from one to two hours and is not followed by hyperemia, unless used in excess and for a long period of time. The extract itself is but little used now; its alkaloids, which are more stable and more convenient for use, have displaced it.

Adrenalin chloride, in solution (1 to 1000 to 1 to 5000), is the widest used of all the derivatives.

Hemostatin solution (1 to 1000), *suprarenin* solution (1 to 1000), and *suprarenatin* (1 to 1000) are all of a similar nature to, and act like, adrenalin. As remedies for the cure of disease these drugs are of but little value. They markedly increase the effect of cocaine, however, and are very useful in operations on the eye to prevent the flow of blood. They should not be combined in solution with cocaine or atropine, but each drug dropped into the eye

separately. When combined in solution with cocaine it seems to cause irritation of the eye.

ANODYNES.

Cocaine, holocaine, eucaine, and all of the local anesthetics are anodynes; but these will be described under anesthetics.

Heat and *cold* also are, in the true sense of the word, anodynes, and the method of their application may be found under their proper headings (pages 103 and 105).

Tincture of opium as a local application has been and is still used for its anodyne and sedative effect. It has been largely replaced, however, by the simple cold and hot applications and the local anesthetics. Poultices of various substances were once much used for their anodyne and sedative effect on the eye, but they, too, have been almost wholly abandoned by the profession, and fortunately so, for, while soothing at first, their ultimate effect was often fatal to the sight of the eye.

IRRITANTS.

Such remedies cause a moderate amount of inflammation, and are used to promote absorption and to stimulate indolent ulcers, etc. The mercury preparations furnish the greatest number of irritants used in the eyes.

Yellow oxide of mercury (*hydrargyri oxidum flavum*) in the form of a salve or ointment (Pagenstecher's), varying in strength from 1 to 3 per cent., according to the effect desired, is the most valuable of all these preparations. Some eyes are much more susceptible to its action than others, and it may have to be reduced to ½ or ¼ per cent. before it is tolerated. Furthermore, unless prepared with the greatest care, the mercury being reduced to an impal-

pable powder, or, better, precipitated from solution, before being added to the base (which may be vaseline and lanolin or benzoinated lard) it causes too much irritation, and does actual harm rather than good. This yellow ointment (½ to 1 per cent.) is a specific in blepharitis marginalis and in phlyctenular keratitis and conjunctivitis. In 3 per cent. strength it is valuable as a stimulant and irritant in chronic and indolent ulcers of the cornea, as in pannus. In molluscum contagiosum it often effects a cure in a few days, if well rubbed into the diseased spots.

Ammoniated mercury (white precipitate), in the same strength ointment as the yellow oxide, is often used in blepharitis and phlyctenular keratitis, when the yellow oxide proves too irritating.

Red oxide of mercury, in the form of an ointment (1 to 2 per cent.), is highly irritating to the eye and is but seldom used.

Mild chloride of mercury (calomel), in powdered form, is often dusted into the eye for its stimulating effect where there is superficial and indolent inflammation of the cornea. The tears are supposed to convert part of it into the strong bichloride of mercury, and it is to the latter that the stimulation is chiefly due; through part of it may be due to the mechanical irritation of the powder rubbing on the eye.

Bichloride of mercury, in solution (1 to 2000 to 1 to 3000), may be used in similar conditions as those where calomel is used for an irritant. It is not so desirable, however, as it does not remain in the eye so long as the calomel.

Sulphate of copper, in the form of a crystal, pure, or mixed with equal parts of alum and nitrate of potassium (*lapis divinus*), mounted in a wood holder for convenient use, is one of the most frequently used stimulating irritants used in ophthalmic practice. In chronic inflammation of

the eyelids (trachoma) it is the sheet anchor when operative procedure is not resorted to.

Sulphate of zinc, in solution (2 to 3 per cent.), is sometimes used as an irritant.

Tincture of opium, once much used as a stimulant and irritant in the eye, has been given up almost entirely. Its action was due to the alcohol contained in the solution.

Counter-irritants.

These are substances used to produce a violent inflammation at some distance from the eye. Their use is indicated only in the deep-seated and chronic inflammations of the eye accompanied with severe pain. The temple and the back of the ear over the mastoid region are the points usually selected for counter-irritation.

Cantharides, in plaster, cut to the desired size, may be placed on the temple or back of the ear and allowed to remain till a blister is raised, when it is removed, the blister punctured and dressed with vaseline; or, if continued effect is desired, it may be kept open with a stimulating ointment, as resorcin. Cantharides collodion may be painted on the temple or back of the ear and the same effect secured as when the plaster is used.

Tincture of iodine may be painted on the temple or back of the ear, where a mild counter-irritant is desired. The nurse should be careful to protect the eye when painting the temple with iodine or cantharides collodion.

Setons, issues, etc., are no longer used as counter-irritants in ocular affections, as they are too severe. Other means more pleasant and more efficacious may be employed.

Caustics.

These are substances used to destroy diseased tissues.

Silver nitrate, "mitigated," that is, mixed with nitrate of potash, in stick form, is much used. Copper sulphate, zinc sulphate, and alum, in solid stick form are all used as mild caustics. Bichloride of mercury in concentrated solution (1 to 250) may be used with an applicator and cotton for the same purpose.

Carbolic acid (phenol), 95 per cent. pure, applied to infective ulcers is most effective. After the eye is cocainized and the surface of the ulcer dried with cotton on an applicator, the base of the ulcer should be touched with the tip of a probe or a wooden tooth-pick which has been dipped into the pure carbolic acid, taking care that no excess of the acid runs into the healthy tissue. A weak solution of alcohol should be at hand to neutralize any such excess. This may be applied by means of a small piece of cotton wrapped on a probe.

Tincture of iodine, 3 to 5 per cent. solution, may be used in the same manner as the carbolic acid, and is a most valuable agent.

Actual Cautery.—This may be applied by heating a probe in a spirit flame and the diseased tissue burned, or the galvanocautery or Paquelin's cautery may be used. The actual cautery is used chiefly to check the progress of infected ulcers and to destroy diseased tissue.

Mydriatics.

These are drugs which dilate the pupil, and the majority of them at the same time paralyze the ciliary or focusing muscle, thereby suspending the accommodation. Their action is local, that is, when dropped into the eye,

they act directly on the iris and ciliary muscles, and their action is confined to the eye in which they are dropped. If used in excess, and especially if allowed to drain into the nose through the tear ducts, or to run down the face into the mouth (as may happen when putting drops into the eyes of a struggling child), symptoms of poisoning may develop. A *secondary* effect, an elevation of tension, or slight hardening of the eye, is sometimes noticed after the use of mydriatics. This is due to the dilatation of the pupil and crowding the iris against the canal of Schlemm, partly closing it, thus preventing a free exit to the natural secretions of the eye. On this account mydriatics are never to be used in glaucoma.

Atropine sulphate is the most widely used of this class of remedies. It is the active principle (alkaloid) of belladonna, and its salts are used in solutions of from 1 to 15 grains to the ounce. The usual strength is 4 grains to the ounce in adults. In special instances, as for breaking adhesions between the iris and the lens capsule, a 15-grain to the ounce solution may be used, but with caution, as poisonous, or "toxic," effects may be caused. The symptoms of atropine poisoning consist in dryness of the throat, difficulty in swallowing, redness and swelling of the conjunctiva and even of the lids, widely dilated pupils, flushed and burning skin, rapid pulse, dizziness, and, in extreme cases, delirium and convulsions. Death may ensue through paralysis of respiration and coma. This poisonous train of symptoms may be due to an idiosyncrasy of the patient for the drug, 1 drop sometimes being sufficient to cause both local and general symptoms of poisoning. Or poisoning may be caused by the careless use of the drug, allowing it to run over the cheeks into the mouth of the patient, or by not holding the fingers over the puncta at the inner angle

of the lids, allowing an excess of the drug to go into the nose, where it is rapidly absorbed. Hence the precautions necessary in the use of this drug.

When a solution of atropine (4 grains to the ounce) is dropped into the eye the pupil is first affected, beginning to dilate in ten or fifteen minutes and is widely dilated in thirty to forty minutes. The ciliary muscle is not affected so quickly, and the accommodation is not suspended for an hour or two. In fact, for complete suspension of the accommodation it is necessary to instill 1 drop of the solution every five minutes for the space of thirty minutes, then wait for from one to two hours, when the paralysis is complete. Atropine is used in this way (*coup sur coup*) to tear away adhesions of the iris from the lens capsule, or to dilate the pupil and relax the ciliary muscle in acute iritis. Usually atropine is instilled but two or three times during the twenty-four hours after the eye is well under the influence of it. It requires about from ten days to two weeks to recover from its effect and sometimes longer.

For its quieting effect, by placing the ciliary muscle at rest, in a splint, as it were, atropine is used in many inflammatory conditions of the eye. In iritis it answers a double purpose: first, to dilate the pupil and prevent adhesions (synechiæ), or to break up the adhesions if they exist; secondly, to place the ciliary muscle at rest and relieve pain.

In ulceration of the cornea, and in the deep-seated inflammations of the eye, as well as in injuries, atropine is used for its quieting and sedative effect. *It is contra-indicated in glaucoma,* and should be used with great care in all aged people, as it sometimes induces glaucoma. In inflammations limited to the conjunctiva and lids it is also contra-indicated. As a cycloplegic, to place the ciliary muscle at rest, in order to adjust glasses to the eye, it has had

extensive use, but is used less and less for this purpose since the introduction of instruments of precision, rendering its employment unnecessary for this purpose, except in children and where spasm of the ciliary muscle is present.

Scopolamine hydrobromate is the active principle of *Scopolia atropoidea* and is much more powerful in its action than atropine. It is used in solutions of from ½ to 1 grain to the ounce (1/10 to ⅕ per cent.) and in exactly the same way as atropine is used. Its action is much quicker than that of atropine, and its effect wears off sooner. One drop instilled at intervals of five minutes for one-half hour (1 grain to 1 ounce in adults and half to one-fourth this strength in children) places the ciliary muscle completely at rest in one hour's time from the beginning of the instillations. The effect wears off in from three to four days' time. On account of its rapid and powerful action, and the earlier disappearance of the effect, it is used in preference to atropine for the adjustment of glasses. The tension of the eye is believed not to be increased by its use, as is the case with atropine, making it safer for use in elderly people. Great care must be exercised in its use, as any excess flowing into the nose or mouth quickly produces alarming toxic effects.

Hyoscine hydrobromate and *hydrochlorate,* which are isomeric with atropine, but much more poisonous, are sometimes used in solutions of from ½ to 2 grains to the ounce, in the same conditions in which atropine is indicated. On account of its poisonous effects it is rarely used, and then usually when atropine cannot be employed.

Hyoscyamine, the active principle of *Hyoscyamus niger,* is used in solution of from 2 to 4 grains to the ounce. When instilled into the eye it dilates the pupil widely in ten minutes, which continues thus for from thirty-five to forty

hours, and does not return to normal for eight or ten days. It paralyzes the focusing muscle in about two hours' time.

Duboisin sulphate and *hydrochlorate*, the active principles of *Duboisia myoporoidea*, act in the same manner as atropine, but more powerfully, and the effects wear off sooner—in five or six days' time. They are used in place of atropine when there is an idiosyncrasy for the latter. From 2 to 4 grains to the ounce solution is the proper strength.

Daturin, the active principle of stramonium, in solution of from 2 to 4 grains to the ounce, acts very much like duboisin and is used under similar conditions.

Euphthalmin hydrochlorate, in 5 per cent. solution, is used for dilating the pupil for diagnostic purposes solely, since it has but little effect on the ciliary muscle. A few drops instilled into the eye causes a maximum dilatation of the pupil in from sixty to ninety minutes, which state is maintained for two or three hours; the pupil gradually returns to the normal size in about twenty hours' time.

Homatropin hydrobromate, a synthetic preparation, is often used in solution (2 per cent.) to dilate the pupil for diagnostic purposes. The pupil begins to dilate in from eight to ten minutes after the first instillation, and with six instillations, at five-minute intervals, the pupil is widely dilated in from one to one and one-half hours' time, returning to the normal in twenty-four to forty-eight hours' time. In 4 per cent. solution it is used as a cycloplegic as an aid in adjusting glasses, 1 drop being instilled every five minutes for thirty minutes, then waiting one hour before the test for glasses is begun. It is not reliable for this purpose, however.

Ephedrin and *mydrin* are other mydriatics used much in the same way and for the same purposes as the weaker

solutions of homatropin. They have but little effect on the ciliary muscle. Ephedrin is used in 2 per cent. solution and mydrin in 10 per cent. solution.

Cocaine hydrochlorate, in from 2 to 4 per cent. solution, is often used as a mydriatic for diagnostic purposes, its effect on the ciliary muscle being but slight. Its action as a mydriatic is brought about by contraction of the blood-vessels of the iris, lessening the volume of that membrane, and perhaps by stimulation of the dilator fibers supposed to exist in the iris. In this respect it differs from the action of atropine, which paralyzes the circular muscle fibers of the iris. Two or 3 drops of a 4 per cent. solution dropped into the eyes cause the pupil to dilate in four or five minutes, reaching the highest effect in from fifteen to twenty-five minutes, and gradually passing off in from four to eight hours. When used in conjunction with atropine it is found to increase the effect of the atropine paralysis, as shown by the pupil becoming wider if atropine is first used until it produces its fullest effect, and then the cocaine instilled into the eye. This undoubtedly is caused by constricting the blood-vessels and lessening the volume of the iris, so that it can be crowded still farther into the iris angle.

Myotics.

These are remedies employed for contracting the pupils. They are also used to reduce the tension of the eye, as in glaucoma, or in threatened perforation of a corneal ulcer, especially if the ulcer is at the margin of the cornea, to lessen the danger of perforation and of prolapse of the iris into the corneal wound should the ulcer perforate; in serous iritis (cyclitis of Fuchs); and at times to counteract the effect of mydriatics.

Eserin sulphate and *salicylate* (physostigmine), in solution of from 1 to 2 grains to the ounce ($\frac{1}{5}$ to $\frac{2}{5}$ per cent.), when dropped into the eye causes the pupil to contract in from four to five minutes, and the ciliary muscle is stimulated to action at the same time. The full effect of the drug on the iris and ciliary muscle is attained in about one-half hour. The effect on the ciliary muscle wears off in about two hours, while the pupil may not return to the normal size for from twelve to forty-eight hours. Eserin has no effect on a pupil widely dilated with atropine, but contracts to a slight extent a pupil dilated from paralysis of the third nerve. Eserin when used in strong solution (4 to 5 grains to the ounce), as is often done to obtain quick results, *e.g.*, in glaucoma, may cause marked circumcorneal injection, spasm of the ciliary muscle, a feeling of tension, and a dragging pain in the eye, with at times neuralgic pains in the temple. It is said to be less irritating when used in oily solution. When eserin is to be used for a considerable time the solutions must be quite weak, from $\frac{1}{2}$ to 1 grain to the ounce; and, when the weak solutions are not tolerated, pilocarpine is used instead of it. If there is any tendency to iritic inflammation, pilocarpine should be used from the first. Eserin finds its chief use to reduce the tension in glaucoma, and, at times, in ulcerative keratitis, especially where there is tendency to perforation and atropine has not proved beneficial, it may be used with benefit. The solution should be kept in a colored bottle and in a dark place; after exposure to light for some time the clear solution changes to a red one. The efficiency of its action is but little affected, however, by this change in color.

Pilocarpine hydrochlorate, the active principle of jaborandi, is used in solutions of from 1 to 2 per cent. Its action on the iris and ciliary muscle is not as strong as that

of eserin, but it has the great advantage of not irritating the eye as does the eserin solutions. Where eserin is not tolerated, and for prolonged use, as in chronic, non-inflammatory glaucoma, for reducing the tension, it is very useful in solutions of from 4 to 8 grains to the ounce. In detachment of the retina, choroiditis, rheumatic paralysis, and tobacco amblyopia the drug is often used hypodermically ($\frac{1}{10}$ to $\frac{1}{5}$ grain) to produce sweating. Great care must be exercised in giving hypodermic injections of pilocarpine that the solution be sterile, the syringe absolutely clean, and the injection given deeply into the muscle of the arm or leg, as abscesses are prone to follow its use.

Anesthetics.

The local anesthetics most commonly used in the eye are: cocaine, holocaine, and eucaine. They produce anesthesia by paralyzing the sensory nerve-fibers with which they come in contact; hence their action is strictly a local one.

Cocaine muriate is the active principle of *Erythroxylon coca,* and is used in solution, as a rule, 2 to 8 per cent., though it may be used in the crystal or powdered forms when intense and quick effect is desired. Its anesthetic properties were discovered by Koller (1884). It is largely employed as a local anesthetic for most operations upon the eye and its appendages, even enucleation of the eyeball having been performed under cocaine anesthesia. As a rule, however, enucleation of the eyeball, or evisceration, and the graver plastic operations about the eye should be performed with the patient under the influence of a general anesthetic. When a few drops of a 4 per cent. solution of cocaine is dropped into the eye it first causes slight irritation, blanching the conjunctiva in from two to five minutes, constrict-

ing the blood-vessels, loss of sensation in the cornea and conjunctiva beginning at the same time and reaching its greatest effect in from six to eight minutes. If the instillations are repeated three or four times at three-minute intervals, in from ten to twelve minutes from the time of the first instillation, the anesthesia becomes sufficiently complete for operations on the eyeball. The pupil is moderately dilated and the palpebral fissure made wider, both brought about through stimulation of the sympathetic nerves to these structures (Fuchs). If the instillations of cocaine are continued too long and too frequently, especially when used in strong solutions, the corneal epithelium is peeled off, an effect which is not desired. Oily solutions (½ to 1 per cent.) of the drug are sometimes used in corneal affections. Adrenalin chloride solution used in conjunction with cocaine seems to increase the anesthetic action of the cocaine. The anesthetic effect of cocaine disappears in from twenty to thirty minutes, but the pupil may remain dilated for as many hours. The accommodation is but mildly affected, being slightly suspended. Toxic effects may result from the too free use of cocaine, especially if allowed to drain into the nose or mouth. They are: dizziness; faintness; very rapid, feeble, and irregular pulse; rapid and irregular respiration, and at times delirium. The patient, under such circumstances, should be laid flat and stimulants applied: whisky, strychnine, etc.

Holocaine hydrochlorate, a synthetic preparation, is a more powerful local anesthetic than cocaine, and in less concentrated solution, a 1 per cent solution equaling a 5 per cent. solution of cocaine in anesthetic effect. The solution has antiseptic properties, kills pus-organisms, and acts as a protoplasmic poison, checking fomentation and putrefaction. When dropped into the eye, a 1 per cent.

solution causes smarting for a few seconds, anesthesia beginning in from three to five minutes and continuing for fifteen or twenty minutes. Repeated in five minutes, operations may be commenced in ten minutes after the first instillation. The drug is more penetrating than cocaine and is very desirable when the iris is to be cut. It allows freer bleeding, however, than when cocaine is used, as it does not contract the blood-vessels. It does not peel the corneal epithelium as does cocaine, and is said not to increase the tension of the eye. The pupil and ciliary muscle are affected but very slightly by way of dilatation of the former and suspension of action in the latter. On account of its toxic effect when injected hypodermically it is rarely used in that manner.

Eucaine hydrochlorate is a synthetic preparation, and comes in two forms: eucaine A and eucaine B. The latter only is used in ophthalmic practice, as the former proves to be too irritating to the eye. Eucaine B is used in 2 per cent. solutions, and, when instilled into the eye, anesthesia begins in two or three minutes, continues for eight or ten minutes, and totally disappears in from fifteen to twenty-five minutes. It does not dilate the pupil, affect the ciliary muscle, or blanch the conjunctiva. It is not as effective an anesthetic as either cocaine or holocaine, and for that reason is not extensively used for operations on the eye.

Miscellaneous Remedies.

Jequirity is a preparation first introduced into ophthalmic practice by de Wecker for the treatment of chronic trachoma complicated with pannus, that is, where the cornea is covered with blood-vessels and opaque epithelium. It may be used in the form of an infusion, as recommended by de Wecker; or, better yet, in the form of a powder, as

recommended by Cheatham. The infusion is made by macerating 3 to 5 per cent. of the powdered bean in cold water for six or eight hours, and is applied to the everted lids with cotton on an applicator once every twenty-four hours, until a violent inflammation is started. Simply dusting the powdered bean over the front of the eye and on the everted lids, as first recommended by Cheatham, of Louisville, is much the better method of application. Within from twelve to twenty-four hours after the powder is dusted into the eye, a violent inflammation, accompanied by marked swelling of the lids, heat, burning, and intense pain, is incited. To control the swelling and relieve the pain the nurse must apply iced cloths frequently, just as in a case of gonorrheal ophthalmia. In from forty-eight to seventy-two hours a membrane is formed on the lids and the cornea, which must be gently washed and rubbed off as it separates from the underlying tissue. In fact, it is to be treated as a croupous or membranous conjunctivitis, which it is, in effect. At the end of a week's time the violent inflammation rapidly subsides, but the clearing away of the blood-vessels and opaque epithelium through inflammatory reaction may continue for weeks; consequently the drug should not be reapplied within four weeks after the first application. Jequirity is contra-indicated unless there is pannus covering the cornea. I have seen some most excellent results from the use of this drug, in fact, useful vision restored, in old trachoma cases with pannus where sight had been reduced to counting fingers. Owing to the violent inflammation which it produces when dusted into the eye, these cases should be taken into the hospital and treated as house cases, and should not be treated as outdoor cases, since there is danger of destroying the eye if it is not properly cared for. I have used the drug often and

have seen it used in many cases and have never had any bad results from its use. It is where the cases are not properly cared for after the drug is used that the greatest danger lies.

Fluorescin is a coal-tar derivative, a staining fluid (2 per cent. solution), used for diagnostic purposes only. When dropped into the eye it stains any ulcerated spot of the cornea a greenish hue, thus indicating the position and extent of an ulcer or abrasion. A drop of cocaine used just before the fluorescin is instilled increases the effect of the latter.

Æsorcin, also a staining fluid (10 per cent. solution), is used for diagnostic purposes only, just as fluorescin. It stains ulcerated surfaces on the cornea red.

Salt (chloride of sodium), in solution (a teaspoonful to the pint), is used for cleansing the eye and for neutralizing the excess of nitrate of silver when the latter is applied in strong solution to the eyelids.

Collodion (flexible) is used for dressing small wounds about the lids. At times it is painted on the lower lids to prevent inversion of them, when such inversion is due to spasmodic contraction, as sometimes happens after operations on the eyeball, *e.g.,* cataract extraction.

Vaseline is obtained from petroleum by distillation. There are two preparations: the yellow and the white. If properly made there is little choice between them. Vaseline is used largely as a base for eye salves and as a dressing after operations on the lids; also frequently to prevent the lids from sticking together. It may be obtained in tubes which is most convenient for use about the eye, and is also the best way of keeping vaseline sterile.

Lanolin is obtained from the grease of wool, and is used extensively as a base for ointments. It is rather stiff when used alone and for that reason is often combined with

vaseline or rose water. It has one advantage over vaseline as a base—that is, it mixes with watery solutions.

Glycerine, in solution (10 per cent.), is frequently used as a vehicle for various eye drops, especially where the drops are used in chronic inflammation of the lids, as in trachoma.

Camphor water as a vehicle for drops is frequently used in the eyes.

Boracic acid, sterilized, in saturated solution, and sterilized *distilled water* are commonly used as vehicles for eye drops.

Bloodletting.

Local bleeding is at times employed in deep-seated inflammations of the eye, as in iritis and irido-cyclitis. This may be accomplished by cupping the temple or back of the ear, or by applying leeches to the temple, or side of the nose, preferably on the temple. At times an artificial leech is used, which is nothing more or less than "cupping" with a special instrument devised by Heurteloup. The object of leeching is to draw away the blood from the inflamed tissues, thereby relieving pain and lessening the inflammatory process. The bloodletting may be repeated at two or three days' interval. To apply the natural leech, the nurse should first wash the spot to which the leeches are to be applied, then holding the larger, bulkier end of the leech in a towel apply the smaller end of the leech, which is the head or biting end, to the temple; or the leech may be placed in a small glass tube and held to the temple. If the leech does not "stick," a drop of blood can be drawn with the prick of a lancet at the site desired, when, as a rule, it at once takes hold. Two to six leeches may be applied at one sitting. They should be allowed to remain on till they drop

off and subsequent bleeding encouraged by the application of warm, sterile water. It is sometimes difficult to stop the flow of blood after leeching. A small pledget of cotton soaked with perchloride of iron applied to the seat of bite and gauze placed over this and a pressure bandage applied is effective in stopping the bleeding. Leeches should be used but once. A supply may be kept on hand indefinitely in black earth.

The artificial leech or cup is applied by first rendering the site of application clean, then scarifying and placing the cup on and allowing it to draw. Subsequent bleeding may be encouraged by warm applications as after the natural leech.

Not only is local bloodletting of value in relieving the congestion and allaying pain in iritis, but frequently is of great service as an adjuvant to mydriatics in dilating the pupil and breaking up synechiæ between the iris and lens. The withdrawal of the blood by lessening the bulk of the iris allows the mydriatic to act more forcibly.

Leeches should not be applied to the lids or the conjunctiva, as they cause local irritation at times, and the bleeding would be most difficult to stop, since there is no firm surface beneath to make pressure against, the only method of stopping the flow quickly and efficiently.

Poultices are no longer used in ophthalmic practice except by ignorant and uninformed individuals. The laity are prone to use poultices, but fortunately are being educated to dispense with these unhygienic and dangerous applications. In hopeless cases, as in panophthalmitis, where there is no chance of saving the sight, a poultice may be used to alleviate the pain. Under no other conditions should it be at all considered.

CHAPTER VI.

REMEDIES AND THEIR APPLICATION (*Continued*).

The Application of Drops—Lotions and Solutions—Solids—Powders—Ointments—Cold—Heat—Massage—Pressure—Hypodermic Injections of Strychnine—Mercury—Pilocarpine, etc.

DROPS.

THESE are applied to the eyes and lids for varying purposes, *e.g.,* to dilate the pupil and paralyze the ciliary muscle, as in iritis; to contract the pupil in glaucoma; for inflammatory conditions of the cornea and conjunctiva; and to produce local anesthesia preparatory for operation. For convenience of use and in order to keep these drops sterile they are kept in bottles which are closed with pipettes or droppers ground at their upper extremities in the shape of a stopper, which fit air-tight into the neck of the bottle. The upper end of the dropper has a rubber nipple which serves to close the opening, and also, by exhausting the air from it and releasing the pressure, to draw a few of the drops from the bottle, which may be instilled one by one into the eye by gently squeezing it (see Fig. 3). Chalk's eye-drop bottle has a thin sheet of India rubber tied across the upper, cup-shaped end of the dropper, and the drops are drawn into it by first pressing the finger on the rubber, then relieving the pressure when the drops are drawn into the tube, when they may be dropped into the eye (see Fig. 4). Andrews's aseptic eye-drop bottle is shown in Fig. 5, and Galezowski's in Fig. 6. Stroschein's aseptic bottle is shown in Fig. 7. It is made of thin glass, is flask-shaped, and the solutions can be sterilized in the bottle by boiling.

This makes it very convenient for operations and where fresh solutions cannot be had frequently. The pipette is made with a constriction in it just above the stopper part (C^1), and above the constriction there is another stopper-shaped bulb (C^2), and on the end of this second stopper is an olive-tipped bulb over which the rubber nipple fits. The

Fig. 3.—Showing Method of Instilling Drops into the Eye.

pipette is constructed in this manner so that the rubber nipple may be removed and the pipette reversed and inserted into the bottle when the solution is to be sterilized. The flask is then held over a flame (gas jet or alcohol lamp) for three minutes, bringing the solution to a boil, thus sterilizing it. The steam escaping through the pipette and around the loose-fitting upper bulb of the pipette serves to

sterilize these. The flask may be held on wire gauze supported by a tripod while over the flame, or with a clamp. The rubber nipple may be sterilized by boiling, or by dipping into strong bichloride of mercury solution and rinsing with sterile water. One minute after sterilization, the pipette can be reversed (with aseptic fingers, of course), the

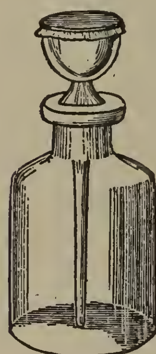

Fig. 4.—Chalk's Eye-drop Bottle.

Fig. 5.—Andrews's Aseptic Eye-drop Bottle.

nipple attached, and the drops are ready for use. In order that the solution may not be made stronger from evaporation through boiling a few drops of sterilized water may be added before boiling the drops.

The usual method of instilling drops into the eye is to sit in front of the patient, the patient also being seated; pull the lower lid down with the index or middle finger; have the patient look up, and gently instill one or more drops on the inside or mucous surface of the lower lid near

the outer corner of the eye. The lid is then released, and by "blinking" the eyelids the patient distributes the fluid over the eye. If the patient is an adult and not nervous, the upper lid may be raised with the thumb or forefinger, the patient told to look down, and 1 or 2 drops of the solution dropped directly on to the cornea. Refractory patients should be made to lie down, or the patient's head taken between the knees, the lids gently held apart with the thumb and forefinger, or both hands used, while a second attendant instills the drops. When drops are used for affections of the lids, these must first be everted (see page

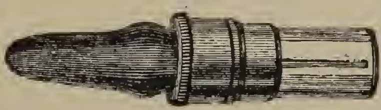

Fig. 6.—Galezowski's Eye-drop Bottle.

96) and the drops applied freely, any excess being taken up with absorbent cotton. In the application of drops to the eye the dropper should not be allowed to touch the eye, neither should it be held too far from the eye, especially if the drops are to fall on the cornea, as they cause the patient to jump, and often shock a nervous patient. After applying drops to the eye the nurse must never fail to place the finger over the tear-sac at the inner canthus, holding it there for two or three minutes and by pressure prevent the excess of fluid from running into the nose; or the lids may be held from the eyes for a few moments, thus preventing drainage into the lacrymal ducts and into the nose. Particular care should be exercised when strong solutions of atropine, scopolamine, cocaine, or any of the powerful alkaloids are employed. It must be remembered that it takes

but a very few drops of a 1 per cent. solution of atropine (the ordinary strength used in the eye) to contain the maximum dose of that drug as administered internally. By allowing several drops of such a solution carelessly to drain into the nose of a child or weakly adult it is easily understood how poisonous symptoms could be brought

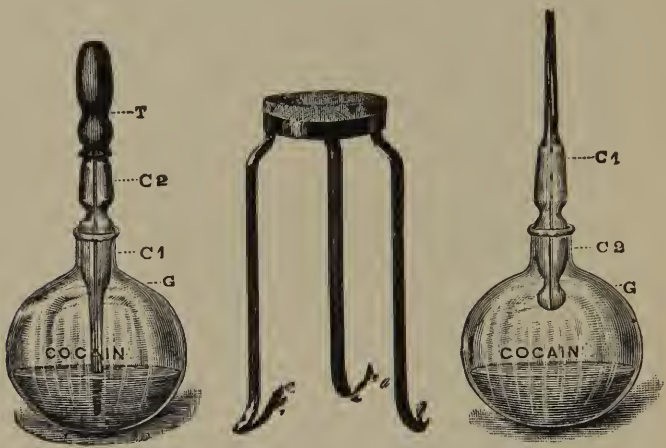

Fig. 7.—Stroschein's Aseptic Drop Bottle and Stand.

about. I presume it is almost unnecessary to say that the nurse should wash her hands after instilling such drugs, if she wishes to avoid applying some of the same to her own eyes by rubbing them.

Application of Lotions and Solutions.

In order properly to apply lotions to the eye the lids must be everted. *To evert the lower lid* place the thumb or index finger on the lower lid just below the lashes and near the center and pull directly downward. *To evert the upper*

lid have the patient look down, catch the lashes between the thumb and index finger of one hand, and pull the lid gently forward from the eyeball, while sudden pressure downward is made at the upper edge of the cartilage with the index finger of the free hand. Unless there is marked swelling of

Fig. 8.—Glass-Stoppered Aseptic Drop Bottle.

the lids, or we have an unruly patient, the lid is easily everted by this simple manipulation. With children we may be compelled to place the child's head between the knees before it can be accomplished successfully and without harm to the eye.

Once the lids are everted, all cleansing lotions are easily applied by squeezing the solution out of a pledget of

cotton on to the lids; any remaining secretion not washed away in this manner must be wiped away from the lids with the moistened cotton, care being taken not to touch the cornea. Solutions not meant for cleansing, but as a local medication to the lids, are best applied with cotton wound smoothly on an applicator, saturated in the solutions, and rubbed on to the surface of the everted lids. The lower lid and *cul-de-sac* are easily treated in this manner. To reach the upper *cul-de-sac* with probe and cotton or solid stick of blue stone or alum is a more difficult matter, unless the following maneuver is used, which renders it easy and safe: First release the lower lid; after the application is made to that part, have the patient look down, evert the upper lid, and make pressure on the upper edge of the everted lid with the thumb; then tell the patient to shut the eye (usually unnecessary, especially with children who try to close the eyes). The pressure at the upper edge of the everted cartilage throws the everted upper lid outward over the lower lid, which latter is squeezed upward under the everted upper lid and at the same time *protects the cornea* from injury. The application is now carried far up into the upper *cul-de-sac, where it should go,* and *without any danger whatever* to the cornea, as the lower lid effectively protects that part of the eye. The applicator (or pencil if solids are being used) is held horizontally and the whole length of the *cul-de-sac* is touched at once. The tighter the lids are squeezed, the farther down is the *cul-de-sac* brought and the more easy and thorough the application (see Fig. 9). I have found the above method of technique so simple and so valuable, particularly so with children, that I have ventured to give it in detail. All the writers I have consulted say that no attempt, except by an expert, should be made to reach the upper *cul-de-sac* because of the danger of in-

jury to the cornea. By this method any competent nurse can do so with safety. I am firmly convinced that many cases of chronic inflammation of the lids are much prolonged because of inefficient and insufficient application of the intended remedy to the upper *cul-de-sac* where it is most needed.

Fig. 9.—Showing how to Make Application to the Upper Cul-de-sac.

Rubber-tipped bulbs or rubber bulbs with rubber nipples, syringes, atomizers, etc., should never be used to apply lotions to the eye. They are inefficient, dirty, and dangerous, both to the patient's and the operator's eyes; to the patient by injury to the eye, to the surgeon and nurse by squirting infectious material into their eyes.

Where the lids are very much swollen, as in gonorrheal ophthalmia, a retractor may be required to lift the lid from the eyeball (see Fig. 10), in order to properly cleanse the eye and make the necessary application. This is to be done carefully, the edge of the lid being lifted slightly from the globe by traction at the upper part of the lid with one hand and the edge of the retractor slipped beneath the lid and pulled upward and backward to expose the eyeball for cleansing and for the application of remedies. There has

Fig. 10.—Showing Method of Placing Retractor Under the Upper Lid.

been devised a hollow retractor with a rubber tube attached to the handles with perforations in the "curved" portion, so that a solution may be transmitted through it while *in situ,* thus cleansing the eye. Its use is not satisfactory, solutions squeezed from pledgets of cotton being more efficient and less dangerous to the eyes, both of the patient and of the operator. Camel-hair brushes should never be used to apply liquids to the eye, as they are difficult to keep clean and the danger of infection being transmitted by them is too great. Cotton wrapped on an applicator, dipped into the solution, is by far the best method of making

such applications, for the cotton is used but once and immediately destroyed.

Eye-cups are sometimes prescribed for patients with which to apply healing lotions to the eyes where the services of a nurse are not required, as in the milder inflammation of the eyelids. They are also at times used as a means of applying hot or cold water to the eyes. They are used in the following manner: The cup is filled to within from an eighth to a quarter of an inch of the top with the solution to be applied, the head is bent forward, the cup applied firmly over the closed eye, then the head is raised and held slightly backward and the eye opened and closed several times. The head is leaned forward again and the cup removed. The second eye may be treated in a similar manner. Each patient should have his own eye-cup, otherwise infection might be transmitted.

Application of Solids.

Pencils of sulphate of copper (bluestone), alum, mitigated silver stick (made by fusing 1 part of nitrate of silver and 2 parts of nitrate of potassium), *lapis divinus* (equal parts of bluestone, alum, and nitrate of potassium, with 2 per cent. of camphor added), are the solid preparations commonly applied to the eyelids in the treatment of trachoma and chronic affections of the conjunctiva. Pencils of these preparations are mounted in holders which have caps to cover them when not in use (see Fig. 11). When applied to the lids they should first be dipped into clean water, then the lower lid everted, and the pencil, held in the horizontal position, applied the full length of the lid and into the *cul-de-sac*. The lower lid is then released, the upper lid everted, and the patient told to close the eyes, when the upper lid, by slight pressure at the upper edge of

the everted lid, is slid down over the lower lid, which covers and protects the cornea. The pencil in the horizontal position is applied to exposed surface of the lid and then into the upper *cul-de-sac*. If there is any pus or muco-pus in the eyes, this should be washed away before the pencils are applied. Any excess of the remedy, as coagulated material after application of the silver stick, may be wiped away with a pledget of cotton moistened in boracic acid or salt solution and squeezed as dry as possible. Where the bichloride of mercury solution (1 to 500) is applied with cotton and applicator, as it is in trachoma, or silver solution in acute ophthalmia (10 or 20 grains to 1 ounce) the excess

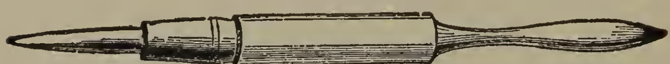

Fig. 11.—Alum Pencil and Holder.

may be washed away with sterile water, or salt solution (1 per cent.) in case of silver.

The nurse should sit in front of the patient, or stand back of the patient (the patient sitting in each instance), when the solid applications to the lids are made. In case of children they may be held in the lap of a second nurse, and the head of the child between the knees, as shown in Fig. 1.

Application of Powders.

The various powders, such as calomel, iodoform, and boracic acid, are best applied to the lids or the eyes by means of a camel-hair brush. The patient's head should be held tilted backward, and the lids opened with the thumb and forefinger of one hand, while a little of the powder is flipped on to the cornea from the brush, being careful not to touch the cornea with the brush. Where the remedy is

to be applied to the lids, they should be everted and the powder dusted on them.

Application of Ointments and Salves.

Ointments are best applied to the eyeball by means of a very narrow short spatula or by means of a small glass rod. The lower lid is drawn downward with the finger, and the spatula or rod, with a little of the ointment on it, is rubbed on to the everted lid. When it is allowed to go back into position and the eyeball massaged for a minute or two with the tip of the index finger over the closed lids to thoroughly apply the ointment. The spatula, of course, is to be cleansed before using on a second patient.

To apply ointment to the edges of the lids, as in blepharitis marginalis, the lids are first thoroughly cleansed of all scales and scabs with a warm solution of boracic acid or soda, then dried, and the ointment rubbed on the edges of the lids, which are closed, with the finger. In case of children it is best to place the child's head between the knees, both for cleansing the eyes and applying the ointment, powders, or other remedies.

Where inunctions of mercury are given, the nurse should be careful to protect her hands with rubber gloves, so as not to medicate herself. Mercurial ointment may be rubbed into the temple or on any other portion of the body, preferably under the arms and inside the thigh, and is designed to remove constitutional disease which causes certain diseases of the eye, as iritis, scleritis, etc.

Application of Heat.

Heat is applied to the eyes for the purpose of relieving pain, preventing inflammation, the promotion of absorption of inflammatory products, and to hasten the formation of

pus in the later stages of inflammation. It may be applied in dry or moist form. The application of heat is especially indicated in inflammations of the cornea, of the iris, and deep-seated inflammations of the eyeball.

Dry Heat.—1. This may be applied to the eye by means of the electric heated pads, which can be attached to any incandescent lamp by a cord which is supplied with the pad. These pads can be had at most drug stores and electrical supply houses. They are very convenient, light, and easily applied. Of course, electricity in the house or hospital is a necessary requisite to its use. 2. Pads of cotton wool or several layers of gauze heated in an oven and placed on the closed eye and covered with oiled silk and held on by a bandage is a convenient method of applying dry heat. 3. A thin layer of rubber protective may be placed over the closed lids and hot wet compresses of absorbent cotton or wool may be applied over this. The rubber keeps the eye dry, and the effect of dry heat is thus obtained. 4. A very small hot-water bag may be used upon the eye, but this has the disadvantage of being heavy and causing pain by its weight.

Moist Heat.—This is best applied by means of pledgets of absorbent cotton or wool. The lids of the eye are greased with vaseline that the skin may not be blistered. A basin of sterilized water (made so by boiling and allowing to cool, 115° F.) is placed on a tripod or a couple of bricks, near the bed, and a spirit lamp or gas jet placed under it and so regulated as to keep the temperature at about 115° F. The pledgets of wool or cotton, which should be rather thick, are dipped into this, wrung out, and placed on the eye. They should be changed every two minutes and this should be kept up for fifteen minutes to half an hour, according to directions of the surgeon. If the pledgets become soiled

from secretions they should be destroyed and fresh ones used.

Application of Cold.

Cold is used on the eyes and its appendages to relieve pain and to prevent and relieve inflammatory symptoms. In inflammatory conditions of the lids and conjunctiva, as in purulent and gonorrheal conjunctivitis, it is indicated particularly in the early stages. In the later stages hot applications are indicated, especially if the cornea becomes involved. In injuries of the eye cold is also indicated. Cold may be applied in dry or moist form.

Dry Cold.—1. This may be applied by putting finely cracked ice in a small rubber bag and placing it on the eye. This method is objectionable because of the weight of the ice. 2. The Leiter coil, which consists of metal tubing of small caliber, coiled, as its name implies, so as to form a disc, is a convenient way of applying dry cold to the eye. One end of the tubing is connected by means of a rubber tube with a large basin of iced or cold water, and this is allowed to drain through the coil, which rests upon the closed eyelids. A thin layer of gauze may be placed over the lids that the coil may not come in direct contact with the lids. The water from the coil is caught in a second basin, and poured again into the first basin if the application is to be made for a long while. As a rule, twenty to thirty minutes at one sitting is quite long enough to apply cold. The objection to the Leiter coil is its weight, which is often uncomfortable to the eye.

Moist Cold.—The best method of applying moist cold to the eyes is by means of pledgets of absorbent cotton moistened and placed on a large cake of ice, allowing them to get thoroughly cold, then applying them to the closed

eyelids. The cake of ice should be large enough to have room for four or six pads of cotton on it at once, so that some of the pads are cooling while those on the eye are in use. The pads should be changed on the eye about every minute, or two minutes at the furthest, and this should be kept up for from twenty minutes to one-half hour at a time. This may be repeated every two or three hours during the day.

Subconjunctival Injections.

In recent years subconjunctival injections of bichloride of mercury have been recommended in certain eye diseases, such as scleritis, episcleritis, irido-choroiditis, etc., with the claim that the remedy has a more direct and specific action than when given by other methods. The conjunctiva is first anesthetized by a few drops of a 4 per cent. solution of cocaine; then the ocular conjunctiva near the equator is picked up with a fine pair of forceps and 8 to 12 minims of a 1 to 1000 solution of bichloride of mercury and 4 to 6 minims of a 1 per cent. solution of cocaine are injected with a hypodermic syringe under the conjunctiva. There is always reaction from this injection; sometimes it is very marked, causing much pain. It should not be repeated until the reaction has subsided. This mode of treatment has not met with much favor in this country. A less severe injection under the conjunctiva is a simple normal salt solution, which has been found to be equally efficacious as the bichloride solution, the inference being drawn that the benefit secured is from the stimulation of the lymph channels, thus increasing the elimination and hastening the cure. Other remedies may be given in this way, but only by the physician.

Mechanical Remedies.

Mechanical remedies, such as pressure and massage, are frequently used in diseases of the eye. The *pressure bandage* is used in ulceration of the cornea as a means of protection and to keep the eye and the lids quiet; also to prevent a perforation of the cornea in deep ulcers of that membrane; to prevent staphyloma (bulging forward) of the cornea; to promote the absorption of extravasations of blood in the lids; also fluid effusions inside the eye, as in detachment of the retina; to prevent excessive swelling of the lids after the operation of "expression" or "grattage" for trachoma; and to prevent hemorrhage. For the method of applying a pressure bandage, see Chapter X. Where there is marked secretion from the conjunctiva bandaging is contra-indicated, unless the bandages are removed frequently to allow the eye to be cleansed.

Massage of the eyeball and the eyelids is sometimes practised with benefit. That which the nurse will be called upon to give will be massage of the eyelids, and occasionally massage of the eyeball indirectly through the lids. The lid affections calling for massage are: (1) blepharitis, in which the yellow oxide of mercury ointment is rubbed into the edges of the lids by a horizontal motion of the finger-tip over the lids; (2) in chronic conjunctivitis, simple massage of the lids by horizontal or rotary strokes improves the condition by stimulating the blood and lymph flow and getting rid of inflammatory products; (3) in deposits of blood under the skin of the lids, after blows, etc., massage is of service in hastening absorption; (4) spasm and twitching of the orbicular muscle are often relieved by massage over the lids and the brow.

The diseases of the eyeball which have been benefited

by massage are: (1) phlyctenular keratitis, in which a small portion of yellow oxide of mercury ointment is placed between the lids and then massage of the eyeball is made by rubbing the lids over the globe for a few moments; (2) in noninflammatory glaucoma, where treatment by medicines or operation is of little avail, massage of the globe through the lids is of benefit in reducing the tension. Rapid rotary movements with the finger-tip are first made over the upper lid, the lower lid being pushed firmly against the eyeball below to steady it; then like movements are made over the lower lid, the upper one being held firmly against the eyeball above. Instead of rotary movements, backward strokes from the center of the lids may be made. Unfortunately the reduction of tension in the eye by this method of treatment remains but a short time.

Massage of the globe by means of a stream of hot water, 115° to 120° F., to remove corneal opacities of a superficial nature, has been recommended, but in my experience, after trying it faithfully, the method proved of but little value.

Hypodermic Injections.

In deep-seated affections of the eye, as in the choroid, retina, and optic nerve, hypodermic injections of strychnine are frequently required. The nitrate of strychnine is preferred to the sulphate for injecting under the skin, as it is less irritating. In optic atrophy due to the use of alcohol and tobacco the nitrate of strychnine in increasing doses, beginning with 1 minim of a solution of 1 grain to the drachm, and increasing the dose 1 minim a day until physiological effect is reached, is of marked benefit. The use of tobacco and alcohol is to be stopped as part of treatment.

Diaphoresis.

Hypodermic injections of muriate of pilocarpine, in dose of $\frac{1}{10}$ to $\frac{1}{5}$ grain, are often employed hypodermically where there is serous exudates in the eye, as in detachment of the retina, to produce excessive sweating. It is also employed in some forms of optic atrophy. The nurse cannot be too particular in preparing the site for the injection, also in the care of the syringe, needle, and solution in giving these injections, as abscesses are liable to follow the injection. The injection should be given deep in the muscle of the arm or leg, and a little gentle massage made for some moments over the spot to promote the absorption of the drug. When profuse sweating has been caused, the night-clothes should be changed for dry ones.

In some syphilitic and rheumatic affections of the deeper tunics of the eye, sweating is of pronounced benefit, and this may be accomplished without the use of drugs, as by the dry pack. Here the nurse wraps the patient in a blanket and covers him warmly in bed, at the same time giving the patient free draughts of hot water. If the sweating is not free enough the patient may first be given a hot bath, then wrapped in blankets, and jaborandi added to the hot water which the patient drinks. Hot-air baths may be used for causing profuse sweating.

Hydrotherapy.

In addition to local hydrotherapy general hydrotherapy is employed in many affections of the eyes, as in ulcerations of the cornea, phlyctenular conjunctivitis, episcleritis, and in the various rheumatic and syphilitic diseases of the eye. The beneficial effects are produced, no doubt, by improvement in the general condition, increased elimination, and

the tonic and sedative effect brought about by the bathing. I have seen, in more than one instance, the steady advance of a destructive ulceration of the cornea checked by Turkish baths, and this after all other means of relief had failed. For the various methods of giving hot baths, cold baths, foot baths, etc., the nurse must be referred to books on general nursing and hydrotherapy, as the space in this small volume is too limited to delve into those subjects.

Diet.

In many diseases of the eye the proper regulation of the diet of the patient as to the kind and the amount of food to be given is of great importance. The nurse will be called upon to look after the diet in operative cases especially. Where the disease of the eye is dependent upon some constitutional trouble, as it is in albuminuric retinitis, diabetic retinitis; and in iritis, episcleritis, etc., of gouty origin; the diet of the patient must be suitable to combat the general disorder. In certain diseases of the eyelids, as blepharitis marginalis, and in some affections of the eyeball, phlyctenular keratitis and conjunctivitis, diseases most often seen in children of a scrofulous diathesis, diet is of the utmost importance in effecting a cure. Without exception, in these latter cases, sweets and pastries of all kinds should be withheld, while a simple plain diet should be insisted upon, such as milk, bread and butter, oatmeal, hominy, rice, eggs, fresh meat once a day, as lamb chops, turkey, chicken, etc.; vegetables, potatoes, string beans, peas, tomatoes, lettuce, chicory, and ripe fruit in limited quantity. Tea and coffee, as a rule, are not good for such patients. In ulceration of the cornea and other affections due to malnutrition, especially in old and in feeble patients, a mild stimulant, as a weak milk punch, may be added to

the diet. In fever patients a fluid diet is to be given, such as milk, soups, etc., or a semifluid diet, as oatmeal, mush, or soft-boiled eggs. After operations on the eyeball where the anterior chamber has been opened, as after cataract extraction, not only is a special diet demanded for a few days, but the nurse is required to feed the patient, since the eyes are bandaged. In such cases, in order to prevent chewing and thereby disturbance of the wound, the patient is fed milk, broths, soups, etc., in the recumbent or semi-recumbent position and through a tube or from a spoon or a special cup, fluids constituting the main source of diet for a day or two, after which soft-boiled eggs, milk toast, shredded lean meat, oatmeal, etc., may be added to the diet. Great care must be exercised by the nurse, when feeding a patient in the recumbent position, not to feed him too fast or to give too large a morsel of soft food at once, because, if the patient is choked and thrown into a fit of coughing, great harm may be done the eye, especially after cataract extraction. As a rule, no fruits or food of a laxative nature should be given to cataract patients until two or three days after the operation, as it is desirable to keep the bowels from moving and the patient from straining at stool for at least that length of time after the operation.

Quiet, Rest, and Sleep.

In the serious inflammatory diseases of the eye, especially those attended with much pain, and after operations, it is essential that the patient be in a quiet place that he or she may secure the proper amount of rest and sleep to sustain vitality and thus hasten the cure. The nurse should talk to the patient only as in the course of her duty demands, and should allow the patient to talk but very little. On no account should friends be allowed to sit and talk

for a long time to a patient who is very ill or shortly after an operation on the eyes. Only recently a lady under my care with chronic inflammatory glaucoma was thrown into an acute attack lasting for a period of twenty-four hours because the nurse allowed a friend of the patient to sit and talk to her for two hours. The patient told me that she was so utterly exhausted and so much irritated by the long visit that she could hardly retain her self-control and that her eye began to pain shortly afterward, though she had had no pain in it for a number of days previously.

Sleep is essential to the healing process. If there is much pain an opiate must be given: morphine, 1/8 to 1/4 grain. If there is no pain, trional, in 15-grain doses, is a reliable hypnotic. Where the eye has to be looked after and cleansed every half-hour, as in gonorrheal ophthalmia and purulent ophthalmia, it is essential to increase the intervals between times for cleansing during the night, say, from one to two hours; because, if the patient is kept awake continuously for two or three days, the general strength is reduced and the vitality so lowered that evil consequences result from lack of general nutrition and rest as well as from the local disease.

CHAPTER VII.

SERUMS AND VACCINES.

Diseases of the Lids—Conjunctivitis—Keratitis—Diagnostic Reactions: Subcutaneous Test—Von Pirquet's Test—Moro's Test—Intracutaneous Tuberculin Test—Therapeutic Reactions—Other Vaccines and Serums—Preparing the Patient—Syringes—Site of Inoculation—Reactions.

SINCE the administration of serums and vaccines are coming more and more into use in the treatment of certain diseases of the eye, the nurse should be trained not only in preparing the patient for their administration but should be familiar with the different methods of giving them and the symptomatic reactions following them. In fact the eyes furnish a most favorable field for the serum and vaccine treatment, as the symptoms especially of a focal nature are so easily observed. R. W. Allen[1], of London, in a quite recent monograph, speaks as follows: "I venture to say that no part of the body gives such striking results in the vaccine treatment of diseases peculiar to it as the various parts of the eyeball."

Some of the diseases of the eye that particularly lend themselves to the vaccine treatment are:

CONJUNCTIVITIS in the intensely acute forms or in the very chronic types; the infecting organism being the gonococcus, pneumococcus, streptococcus, bacilli tuberculosis, Morax-Axenfeld, Koch-Weeks, Friedländer, coli, etc.

Recurrent styes, due to streptococcus, staphylococcus.

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[1] Allen, R. W.: Practical Vaccine Treatment, London, 1919, H. K. Lewis.

Lacrimal sac inflammations, due to streptococcus, staphylococcus, pneumococcus or colon bacillus.

KERATITIS, especially the infectious ulcers of the cornea due to the gonococcus, pneumococcus, and streptococcus; also in the recurrent phlyctenular forms of keratitis.

SCLERITIS, due to bacillus tuberculosis, bacillus coli, pneumococcus, streptococcus, etc.

Also in the deeper infections of the eyes as in the iris, ciliary body, choroid, retina, etc., often due to the streptococcus, pneumococcus, gonococcus, staphylococcus, and the tubercle bacillus, etc.

Although I have had but little experience in vaccine treatment in general bodily diseases, except as affecting the eyes, I can fully confirm Allen's claims as to the efficiency of the vaccine treatment in the diseases of the eyes. In many infective diseases of the eye vaccine treatment is imperative, if we would save the sight of the eye, the eye itself, and at times the life of the patient.

Well do I remember one patient who had injured the upper eyelid, a druggist had closed the wound with adhesive plaster; twenty-four hours later, an abscess formed in the eyelid; yet another 48 hours and the whole side of the face was swollen and the lymphatics of the neck enlarged, and high temperature followed. Prompt evacuation of the pus was made and a large dose of stock polyvalent vaccine was given at once. An autogenous vaccine was made from the pus (streptococci and pneumococci being the infecting organisms) and a large dose (200,000,000) of this was given 48 hours after the stock vaccine. This was repeated in 48 hours, and although part of the skin and muscular tissue of the upper lid sloughed away the eye was preserved with little deformity of the lid and with good vision. In my opinion the life of the patient was saved by

this prompt action as the infection was acute and virulent. Of course this is an exceptional case, but it illustrates the value of vaccine treatment if used early and energetically.

Another reason for the early use of the vaccine treatment in the acutely infective diseases of the eye is that such infections usually develop very rapidly and do much damage to the eye in a short time. Hence the great necessity for early and active treatment. Especially is this so in cases of gonococcic and pneumococcic ulcers with hypopyon. In the subacute and more chronic infections of the eye as in some of the cases of chronic conjunctivitis, recurrent styes, keratitis, scleritis, etc., the vaccines often yield brilliant results when all other remedies have failed. The nurse, therefore, who is engaged in special nursing should familiarize herself with the administration of the vaccines and the reactions following the injections of the vaccines so as to report to the surgeon in charge and properly chart the symptoms.

Diseases of the Lids.

Recurrent styes and chronic *blepharitis marginalis* which have resisted other treatment, often yield to vaccine treatment. Staphylococci, occasionally streptococci, and infrequently acne bacilli enter into the etiology. An initial dose of 250 million staphylococci, 50 million streptococci and 5 million acne bacilli, followed by larger doses (double) at weekly intervals often effect a cure (Allen). However, it must be stated that the vaccines sometimes fail in these cases, at least such has been my experience.

Conjunctivitis.

In the chronic and more stubborn types due to the Koch-Weeks bacillus and the Morax-Axenfeld bacillus or at times the staphylococcus and the bacillus of Friedländer,

the vaccine treatment often proves of the greatest benefit in effecting a cure and this after the cases have been of very long duration. The initial dose in these cases should be from 100 to 250 million in adults and one-half to one-third this amount in the cases of children, increasing to double this amount or more in subsequent doses, the interval of doses is about five to seven days depending on the reaction produced by the injection. It is in the acute forms of hypopyon conjunctivitis that the vaccine treatment brings the most gratifying results with the saving of sight and the eyeball itself. In such cases Allen thinks that "vaccine treatment should be little short of compulsory." In these acute cases of gonococcal and pneumococcal conjunctivitis, especially when complicated with hypopyon, not only should the local treatment be given (which see under respective headings in preceding chapters) but active vaccine treatment should be instituted. The initial dose in such cases should be 250 million and subsequent dose up to 500 million or more at three- to five- day intervals. Children should have about one-half the dose of adults.

Keratitis.

In serpiginous ulcer of the cornea which is due to pneumococcal infection, Allen claims that vaccine treatment is especially efficacious, succeeding even in those cases where the serums have failed. It should be borne in mind however, both by the surgeon and the nurse, that careful and well directed local treatment in such cases is most essential in addition to the vaccine treatment and should not be relaxed for an instant. Atropine, argyrol (50 per cent. solution), hot fomentations, and the actual cautery at times, all have their place in the treatment and should never be lost sight of.

In the deeper infections of the eye, as in iritis, uveitis, the cure may be effected in some of the chronic cases only by vaccine treatment. Diseased teeth or tonsils may be the cause and the streptococcus viridans in such cases has often been found to be the inciting organism. Besides removal of the tonsils and removal or treatment of diseased teeth, often the vaccine treatment must be employed before a cure is effected. Unhappily, at times every treatment proves futile to avert the progress of the disease.

In recent years it has been found that many affections of the eye, which may be situated in any part of the organ—the conjunctiva, cornea, sclera, iris, choroid, retina—may be due to the tubercle bacillus, or its toxins. In such cases the vaccine treatment is of the utmost importance. In addition local and general treatment should be given; atropine, hot fomentations, shaded glasses should be used, general tonics, and all hygienic surroundings should be attended to. So important are the reaction symptoms (diagnostic and therapeutic) following the tuberculin tests and treatment that I venture to give a brief description of same here.

Diagnostic Reactions.

As is well known, the diagnostic value of tuberculin depends on the reaction it produces when brought in contact with the living organism, either by dropping it on mucous surfaces, rubbing it on the skin, by vaccination into the skin, or injecting it into the skin or under the skin. Of the nature of this action, or rather reaction to tuberculin, some words of explanation are here necessary, though space does not permit a full description of same.

Three factors are comprised in the tuberculin reaction:

1. *General* or constitutional reaction, which consists in a rise of temperature, a feeling of malaise, accompanied

at times with vomiting, headache and eruptions on the body, the temperature changes being the most important symptom of the general reaction.

2. A *local* reaction, resulting in a nodule or infiltration at the site of the vaccination or injection, which may be slight or extensive and may cause enlargement of the neighboring glands.

3. A *focal* reaction, which consists of lighting up anew or increasing the inflammatory process at the site of the lesion.

Of these three factors in the tuberculin reaction, in ophthalmic cases, the focal reaction is the most reliable as an indication that tuberculosis is the cause of the eye trouble, though the primary focus of infection may not necessarily be in the eye itself.

The local reaction at the site of injection or vaccination comes next in importance, while the general or constitutional reaction, of which temperature is the chief indication, is the least important from a diagnostic point. The alteration of the temperature, a rise or a fall, is, however, the most important guide that we possess in administering the therapeutic injections of tuberculin; but of this I shall speak later.

For diagnostic purposes the old tuberculin of Koch is employed in several different ways, almost to the exclusion of all other tuberculins. The one exception to this is the washed precipitate of old tuberculin used by Calmette and others in the conjunctival tests. But even here many observers prefer the dilutions (1 per cent., as a rule), of Koch's old tuberculin to the precipitated solutions (0.5 to 2 per cent.) used by Calmette and his followers. As the Koch solution is weaker, it is safer and not so apt to cause excessive reactions as the stronger precipitated solutions.

The Subcutaneous Test.—All told, this is the best and most reliable of the tuberculin tests. Before it is given, however, the patient's temperature should be taken four times a day for two days previous to the test. If there is found any considerable temperature elevation it is best not to give the test until this has abated.

The indications of a positive reaction are:

1. Constitutional Symptoms: The chief of these is a rise in temperature which may be, and often is, accompanied by a feeling of depression and malaise, chilly sensations, headache, aching pains in the back and, at times, nausea and vomiting, and eruptions on the body.

2. Local Symptoms: Redness and swelling at the site of the injection appear, sometimes accompanied by swelling of the near-by lymph-nodes.

3. Focal Symptoms: In case of ocular tuberculosis, there is increased irritation and exudation at site of disease; pain, and flashes of light if the retina is involved.

As to the constitutional symptoms, it is desirable not to have intense reactions but only a very slight rise of temperature, and neither should there be produced but the slightest focal reaction in the eye, especially if acutely inflamed already, because great and permanent damage may be done if the lesion is in the retina or choroid, by the excessive inflammation produced.

The initial diagnostic dose of Koch's old tuberculin for injecting under the skin should not be greater than 0.5 mg. If a reaction takes place it will occur usually in from six to ten hours and reach its height in from twenty-four to forty-eight hours. If the first injection is not positive, after forty- eight hours, a second injection of 2 mg. may be given, and if this does not react in forty-eight hours, then a third injection of 5 mg. or 10 mg. may be given. If

no reaction follows, this is strong evidence that the ocular lesion is not of tuberculous origin. If a positive reaction takes place, especially if a focal reaction occurs in the eye, it is strong evidence that the ocular disease is due to a tuberculous lesion, the primary tuberculous lesion not necessarily being in the eye, as a tuberculous lesion in some distal portion of the body, as is well known, may cause ocular disease.

Von Pirquet's Test.—This test consists in vaccinating the patient with old undiluted tuberculin. The arm is usually the place selected. After cleansing with alcohol a small scarification is made, just sufficient to have a little oozing, but no bleeding. Then the tuberculin is rubbed into this spot and allowed to dry. A second scarification about one inch distant from this is made, simply as a control. The arm is protected with a light piece of sterile gauze held on by strips of adhesive plaster. At the end of from twenty-four to forty-eight hours, the reaction, if positive, is usually at its height. Three degrees of reaction are noted: (1) mild, where the skin at the site of the vaccination is reddened and slightly infiltrated for a distance of 5 or 6 mm. around the vaccination; (2) moderate, more redness and wider infiltration and slight elevation of skin, perhaps double that of the mild; (3) intense, where the redness and infiltration extends an inch from the vaccination, accompanied at times with vesicles and occasionally with enlargement of the neighboring lymph-nodes. In two instances I have had, in addition, a constitutional reaction with rise of temperature, malaise, etc., and also a focal reaction in the eye. In one of these patients a Pirquet test had been made twelve days previously with a 25 per cent. solution of old tuberculin, with a negative result. I may say that the subcutaneous diagnostic test confirmed the diag-

nosis in these two cases and that therapeutic injections cured the patients of their ocular lesion, one a keratitis, the other a chorioiditis.

A positive Pirquet test in young children is of value as indicating the presence of a tuberculous lesion somewhere in the body; in older children it is of doubtful value, and in adults it cannot be depended on. When the Pirquet test is negative, however, especially when repeated a second time, it is practically certain that there is no tuberculous infection anywhere in the body.

Moro's Test.—This is somewhat similar to Pirquet's test—in fact is a modification of it. A 60 per cent. ointment of old tuberculin (the base being lanolin) is used to make the test. A piece the size of a pea is thoroughly rubbed into the skin covering a space of from one to two inches in diameter. If positive, in from twenty-four to forty-eight hours, small papules appear at the site of application of the ointment, more or less numerous according to intensity of reaction. The test is variable and not very reliable.

The Intracutaneous Tuberculin Test.—Here the tuberculin is injected into the layers of the skin (infiltration); this is a very delicate test as to tuberculous infection, as is also the subcutaneous local or depot test. But both of these tests are positive so often, especially in adult life, that they are not of value for diagnostic purposes.

My own method of procedure in a suspected case of ocular tuberculosis is to first make the Pirquet test with the undiluted old tuberculin of Koch. If the test proves negative it practically excludes tuberculosis as a cause. If still in doubt, however, the test is repeated in three or four days' time. If again negative, tuberculosis is excluded as a cause of the ocular trouble. If the Pirquet test is posi-

tive, unless in a very young child, the test is supplemented by the subcutaneous test, 0.5 mg. of old tuberculin, being given. If this is negative, a second injection of 2 mg. is given; if this is negative still, a third injection of 5 mg. is given. This proving negative, tuberculosis may be excluded as a cause.

When the subcutaneous test proves positive, especially if a focal reaction takes place, we may decide definitely that the ocular trouble is of tuberculous origin, and proceed with therapeutic injections.

Therapeutic Reactions.

As to the methods of administration of tuberculin in the treatment of ocular diseases, I may say there are two schools of therapists. The first consists of those who wish to avoid reactions, especially of a focal nature, and, following Wright's lead, they give extremely small doses of tuberculin, for example, T. R. or B. E., the initial dose being $\frac{1}{80,000}$ to $\frac{1}{10,000}$ mg., increasing the size of the dose very slowly, while the interval between doses is wide, from ten to twelve days, and the treatment is prolonged over a long period of time. The second school, consisting of those who wish to produce mild reactions, following the von Hippel method, begin with larger doses of T. R. or B. E., the initial dose being $\frac{1}{500}$ to $\frac{1}{1000}$ mg., which is increased in size rather rapidly, $\frac{1}{500}$ to $\frac{1}{1000}$ mg. each dose and the doses are given at intervals of from two to five days or, in some cases seven to ten days, until as much as 1 or 2 mg. may be given at a single dose, care being taken, however not to cause too great a reaction; for example, not to raise the temperature more than 0.5 to 1° F. above normal, or to cause more than the mildest focal reaction in the eye, be-

cause a severe reaction in the eye may cause a lasting injury to the vision.

When the dose has been increased to the point of producing reaction, it should be held at this till the reactions cease, then gradually increased again, with slightly longer intervals between doses, till slight reactions are again produced, then repeat the procedure as before. This method is followed until the reactions cease or the patient is cured. The temperature is the most important guide we have in regulating the course of the treatment; this, together with the general condition of the patient, whether he is made to feel stronger and more cheerful, or is depressed (put in the "negative phase," so to speak), and a close observation as to any focal reaction, gives us all the evidence we need by which to proceed.

Other Vaccines and Serums.

The serums most commonly used in the diseases of the eye are: (1) The well known antitoxin (diphtheritic) which is used to neutralize the toxin or poison secreted by the diphtheritic bacillus, and (2) antibacterial serums such as are used to destroy the pneumococcal and streptococcal bacilli themselves. The remedies may be given intramuscularly or intravenously, but the more common way is to give them subcutaneously. While it is a very common procedure to give the antitoxin (antidiphtheritic) in cases of laryngeal and nasal diphtheria, it is rare to administer it for ocular diphtheria, because the infection in the eye usually is secondary to the throat infection. However, subsequent injections are often necessary and the nurse should be familiar with the method of giving same. As the method of preparing the patient and the precautions as regards herself and the public in such cases have been gone into very

thoroughly by Dr. Douglass in the section on diseases of the throat, the reader is referred to that section, Chapter VI.

Preparing the Patient.

The temperature, pulse, blood-pressure and the general condition of the patient should be ascertained before any vaccine or serum treatment is undertaken. The run of the temperature morning, noon, and night should be had for two or three days in cases where diagnostic doses of tuberculin are to be given (which see above).

Syringes.

The best syringe for giving the injections is that of Luer, which is all glass and graduated both in minims and cubic centimeters, and vary in capacity from 1 to 10 c.c. Not only are they well made but the needles are sharp and extra needles may be had in separate boxes. Before giving the injection the needle and syringe should be boiled in absolute alcohol and after injection the needle should be again disinfected and dried, and the piston left out of the syringe—the needle of course having a wire inserted to keep the opening free.

The Site of the Inoculation.

This is of some importance; first, the injection should be in a place where the circulation is active; second, in case of a female the arm should be avoided, so in case a scar should result that it would not show. In the male, usually the upper arm, abdomen, or the buttocks is selected for the injection; in the female, the site of the injection is between the scapulæ, the abdomen, or the leg. In very stout subjects the buttocks and the abdomen should be avoided when deep

injections are given, as the thick layer of fat in such patients prevents the rapid absorption of the remedy and may even endanger the life of the patient. Allen cites a case where a mixture of adrenalin and pituitary extract was injected into the buttocks. "Three inches of fat lay over the muscles; the highly vaso-constrictor fluid failed to absorb, autoinfection by the bacillus coli ensued, and the patient died of septicemia."

Having selected the site of the injection the part should be painted with a three and a half ($3\frac{1}{2}$) per cent. solution of iodine; or the parts may be cleansed with green soap and water and followed with a $\frac{1}{2000}$ solution of bichloride of mercury, or 95 per cent. alcohol.

Some of the complications following these injections may be: (1) piercing a small vein resulting in a marked discoloration, or, at times a hematoma; (2) piercing a nerve sheath, when the pain may be severe if the injection is given in the nerve sheath; (3) abscess formation may follow if the injection is not given under strictly antiseptic precautions. According to Allen, abscess formation may follow in some cases even where all antiseptic precautions have been taken, *e.g.*, where large doses in small bulk are injected and the absorption is slow.

Reactions.

The reactions following the diagnostic and therapeutic injections of the tuberculin vaccines have already been given in detail (which see above). The reactions following the subcutaneous injections of the other vaccines commonly in use, as streptococci, pneumococci, staphylococci, etc., briefly stated may be summarized as follows: (*A*) *Local.*—Redness, swelling, tenderness, and pain may come on after six to twelve hours and usually pass away in from one to

three days. Occasionally, however, the local reaction may be very severe, that is marked edema, redness and pain with enlargement of the neighboring lymphatic glands may result. In fact the pain may be so great as to call for an opiate and the application of very hot or very cold compresses. (*B*) *Focal.*—Focal symptoms may appear in twenty-four to forty-eight hours or even for three or four tenderness, redness, pain, photophobia, lacrymation, etc. (*C*) *General.*—General symptoms may appear as early as six hours, usually after ten to twelve, but may be deferred twenty-four to forty-eight hours or even for three or four days, manifested usually by a slight rise of temperature, increased pulse rate, chilliness, rigors, and, at times, by vomiting and great depression. The temperature at times may go very high, or again the temperature may drop one to three degrees below normal—the so-called *negative phase* of the reaction, accompanied by weakness and great depression.

Headaches are not uncommon, and skin eruptions of varying intensity, from simple erythema to urticaria and marked and extensive eruptions all over the body may result. These eruptions and other unpleasant symptoms clear up after a few days as a rule.

In administering all these vaccines it must be kept in mind both by the doctor and the nurse that powerful toxins are being used and that great harm and even fatal results may follow if the greatest care is not observed in giving them. The surgeon of course decides on the size and the interval of the dosage, but he must be guided in a great measure by the faithfulness with which the symptoms of the reactions are recorded by the nurse, and it is the nurse's duty not only to record temperature and respiratory changes but to make careful note of the general condition, appear-

ance, and feeling of the patient following these injections, since they have a most important bearing on the handling of the case. For instance, change in the temperature or pulse rate may be accompanied by great depression, the patients not infrequently stating that they feel "shot to pieces," following the injection. On the other hand the temperature and pulse change may be decided and yet no depression or ill effect follow. It behooves the nurse, therefore, in such cases to be especially alert and to note well all the symptoms in these cases where such powerful and toxic remedies are being given.

CHAPTER VIII.

OPERATIONS ON THE EYE.

Asepsis and Antisepsis—Preparations of the Operating Room—Operating Table—Sterilization of Instruments, Ligatures, and Dressings—Preparation of the Patient—Anesthesia, General and Local—The Different Operations.

Asepsis and antisepsis as practised in general surgery are to be followed in the same manner, with some modifications, in ophthalmic surgery. In preparing the patient, operating room, instruments, dressings, solutions, etc., the same rigid antiseptic methods as in general surgery are followed, as is also by the surgeon, assistants, and nurses in disinfecting and making their own hands clean. In preparing the field of operation, especially when the eyeball is to be operated upon, the strong antiseptic solutions should not be used, as the eye, being such a delicate organ, is much irritated by their use and the success of the operation often imperiled. If used at all, it should be the day previous to the operation and the eye bandaged, and a mild, aseptic solution or sterile water used to bathe the eye just before the operation.

Antisepsis and Asepsis.

Antisepsis, in the broadest sense, as it pertains to surgery and surgical dressings, may be defined as the means and methods employed to destroy disease and pus-producing germs, while asepsis is the art and science of keeping free from such germs.

Antisepsis may be accomplished in various ways: by means of: (1) soap, water, and scrubbing; (2) the use of the chemical antiseptics, as solutions of bichloride of mercury, carbolic acid, cyanide of mercury, formalin, alcohol, ether, iodine, etc., or by heat, dry or moist. Dry heat and steam are employed largely for sterilizing dressings, bandages, towels, aprons, and gowns, while instruments and solutions are quickly and efficiently sterilized by boiling.

Tincture of iodine, in 3 per cent. solution, painted on the skin about the closed eyes and on the eyelids themselves, where plastic operations are to be performed, is a most efficient antiseptic, and is to be recommended. After a plastic operation if a light coat of this solution is painted over the sutures it furnishes an added protection against stitch abscess.

Further, where stitch abscesses have formed, with removal of the stitches and an application of a 3 per cent. solution of tincture of iodine, we have the best method of preventing further infection.

Asepsis is surgical cleanliness. After a wound is made the greatest care must be exercised to keep it clean and free from germs. This may be done during or immediately after the operation by irrigating the operated surface with some sterile solution, a plain, sterile water or boracic acid solution. After the operation sterile dressings are applied, and at subsequent dressings the same care in asepsis must be followed until the wound is entirely healed. If the wound becomes infected from any cause, antiseptic solutions may be required to cleanse it, but they should not be strong enough to produce any sloughing of the tissue. Where wounds are septic from the beginning, as in abscesses, antiseptic solutions must be used until the wound is free of pus.

Arrangements for Operations.

Operating Room.—If in a hospital, it should be made antiseptically clean, of course, as for a general surgical operation. The operating table should be placed near a window in order to get side light, if daylight is to be used. If artificial light is to be employed, the table is to be placed near and to the side of the source of light. Light coming from above, as from a skylight, is bad for operations on the eye, as it casts confusing shadows on the field of operation. If the operation is to be performed in a private house, the nurse may have to improvise an operating table, as a lounge, library table, kitchen table, etc. On this table should first be placed blankets, over this a rubber sheet, and over this a cotton or linen sheet. The pillow should be covered with a piece of rubber sheeting and over this an antiseptic towel may be spread. Near the operating table and on the side opposite from the light should be a small table to hold the instruments, tray, dressings, solutions, towels, etc. This table should be washed with soap and water and an antiseptic solution, and finally antiseptic towels spread on the top of it. A second small table may be necessary to help hold the dressings and solutions. In hospitals one small table made of iron and glass and having two shelves is quite sufficient. If a general anesthetic is to be given a small table should be provided to hold the anesthetic, inhaler, tongue forceps, mouth-gag, hypodermic syringe, solution of nitroglycerine, whisky, camphor, nitrate of amyl, a pus basin for vomited matter, pads of sterile gauze or towels for wiping the patient's mouth, and a galvanic battery. All hangings and articles of furniture unnecessary for the operation should be removed from the operating room. This is meant especially in private houses, since in regularly ap-

pointed operating rooms unnecessary articles of furniture are not permitted. It is always to be remembered by the nurse that the operating room should be warm, from 76° to 80° F., especially where a general anesthetic is to be given, as the patient is lightly clad and entirely relaxed while under the anesthetic. The room should be well ventilated.

Instruments.—In all well-regulated hospitals there are dust-proof, air tight, iron and glass instrument cases with convenient shelves and racks for holding instruments and ligatures. It is the nurse's duty to keep the instruments clean, dry, and well arranged in these cases, and before an operation it is necessary for her or a house surgeon to pick out the necessary instruments for the operation. If knives, knife-needles, or keratomes are to be used, a test-drum should be convenient and handed to the assistant or the surgeon to test the sharpness of the instruments before they are sterilized.

Eye instruments are so small and delicately made, especially knives, knife-needles, and fine-pointed scissors, that they are often dulled or ruined by the nurse in handling and sterilizing them, unless she has had special directions and warning in the matter, and I speak feelingly on the matter, having suffered both in temper and pocket from such source. The larger instruments, as speculum, enucleation scissors, tenotomy hooks, needle-holders, etc., may be boiled for from four to five minutes in a 1 per cent solution of soda, or they may be sterilized by steam. After taking the instruments from the boiling water or steam they are placed in a 3 per cent. solution of carbolic acid for five minutes, then rinsed in sterile water and placed in an instrument tray or rack ready for use near the operating table, a sterile towel being spread over them. Or, after boiling, the instruments may be placed in a 1 per cent. solu-

tion of cyanide of mercury for five minutes before use. Some surgeons prefer to have the instruments dipped in alcohol (95 per cent. pure) immediately after boiling, which dries them quickly. Cataract knives, keratomes, and knife-needles should only be dipped into boiling soda solution (1 per cent.) for about one minute, placing them in racks or holding them with forceps and not allowing the instruments to touch the sterilizing basin for fear of dulling them. They are then dipped into alcohol for one minute, rinsed in sterile water, and placed in special trays or racks, ready for use, being careful not to touch the blades on the rack or tray. Some surgeons prefer to have these finer instruments simply dipped in 95 per cent. pure alcohol and dried just before using, while others have them dipped in boiling water only and dried just before using.

Soft, sterile gauze or soft, old linen should be used for drying instruments, and not cotton, as is sometimes done. If cotton is used, fine shreds are apt to cling to the instruments and be introduced into wounds or into the eyeball itself. Needles should be stuck in a piece of gauze before being put into the sterilizer to prevent their being lost.

Instruments with ivory handles should not be boiled, but dipped into boiling water just for a moment, then immersed in a 5 per cent. solution of carbolic acid for five minutes, and dried with sterile gauze.

Syringes may be sterilized by soaking in carbolic solution, 5 per cent., for twenty minutes, then boiling water drawn into them and emptied several times to have them ready for use.

Immediately after operation, cataract knives and keratomes should be dipped into boiling water and cleansed, then into alcohol, dried, and placed back in the case. The teeth and catches of forceps, joints of scissors and needle

holders, needles, and cystitomes should be cleansed in a hot 1 per cent. soda solution and with especial care, a fine brush being used for this purpose. They are then dipped into alcohol, dried, and put away.

Dressings.—Bandages, eyepads, cotton and gauze sponges (mops), gauze and gauze strips, towels, and gowns for the surgeon and attendants are best sterilized by steam. Several sterilizers for this purpose have been invented, one of the best being that of Schimmelbusch. In this there is a compartment below for boiling the instruments and compartments above for sterilizing dressings by means of the steam. It takes but four or five minutes to sterilize the instruments, but the dressings should be allowed to steam for at least one-half hour. The large hospitals have hot-air sterilizers, in which towels, bandages, dressings, gowns, etc., are sterilized at a temperature of 300° F. for the space of one hour. For private use, the Rochester combination sterilizer shown in Fig. 12 is excellent. It is very much like the Schimmelbusch sterilizer, and any of the three sterilizing agencies, dry heat, steam, or boiling water, may be utilized at will. The sterilizing chamber, by the simple turning of a valve, may be filled with either steam or hot air, and in this way instruments or dressings may first be subjected to dry heat, then steam, sterilized, then thoroughly and quickly dried by hot air. The apparatus consists of a double-walled chamber. The outer wall rests in the groove of a removable base, which forms a water-joint. This base may be used for sterilizing instruments with boiling water (1 per cent. soda solution), if desired, and dressings, gowns, etc., may at the same time be steam sterilized in the chamber above. With the sterilizer there are two removable wire-cloth racks: one for dressings, the other for instruments. The instrument rack is built to fit either

the chamber or base. The Rochester combination sterilizer is made in various styles and sizes for both hospital and

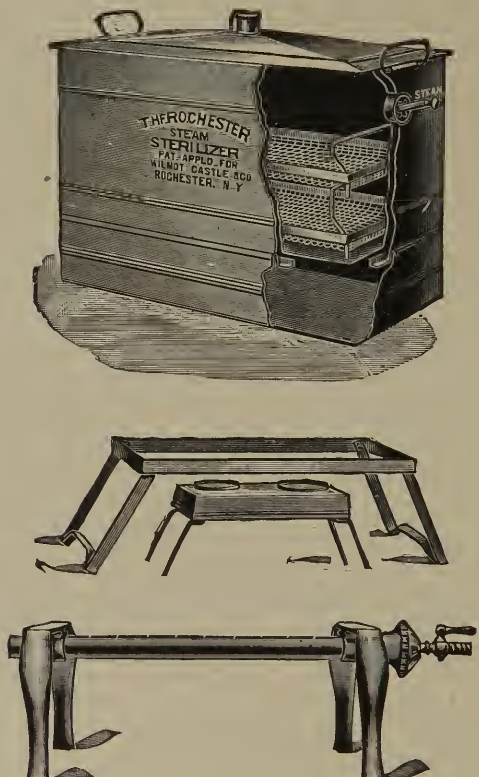

Fig. 12.—Combination Hot Air, Hot Water, and Steam Sterilizer.

physicians' use, and special sizes are made to order. The bottom is heated by means of a stove, spirit lamp, or gas jet. The apparatus is very simple, efficient, and cheap, and

can be carried easily in the hand. A most convenient sterilizer for the office is the small electric one; especially useful for sterilizing droppers, probes and instruments for minor operations.

Suture Material and Ligatures.—Silk is the most common suture material used in operations about the eye, and this is usually the iron-dyed, so that the stitches can be readily seen when it is time for their removal. Occasionally catgut is used, but this comes sterilized ready for use. For that matter, silk sutures most often come in tubes or on spools in bottles, sterilized ready for use. Silk sutures may be sterilized by dry heat, one hour, or simply by boiling for a few minutes in 1 per cent. soda solution, or in a solution, 1 to 1000, of bichloride of mercury. A small glass spool or reel is convenient for wrapping the silk on while sterilizing. After sterilization the material is kept in small bottles immersed in alcohol until ready for use.

All dishes, trays, racks, bowls, etc., intended for holding instruments and dressings, should either be boiled for ten minutes or boiling water poured over them and in them, then rinsed in carbolic solution (1 to 20) and dried with a sterile towel. Bottles, droppers, and receptacles intended for solutions may be sterilized in the same manner. The solutions themselves intended for use in the eye, except the antiseptic solutions, must be sterilized before use. Solutions of cocaine, atropine, eserine, etc., should be made sterile by boiling, if not sterilized by the apothecary when compounded. This may be done by placing the solution in the Stroschein flasks, already described on page 92 and boiling for two or three minutes, not longer, when, after cooling for a few moments, the solution is ready for use. If these flasks are not convenient, an ordinary test tube may be used to boil the solution in; or the original bottles

may be unstopped, set in a basin of boiling water, and boiled for five minutes.

THE NURSE'S HANDS.—Just as the hands of the surgeon and attendants must be made thoroughly aseptic before an operation, so must the hands of the nurse. This may be accomplished in one of several ways. As a preliminary measure in every instance, the nails should be cut short, and carefully cleansed with a nail-file. The method of disinfection may then proceed. One commonly followed by many of the surgeons at the New York Post-graduate Hospital is as follows: (1) the hands and arms are first thoroughly scrubbed with soap and water with a brush; (2) dipped into alcohol (95 per cent.) for one minute; (3) dipped into permanganate of potash solution (2 per cent.) for from three to five minutes; (4) bleached in a saturated solution of oxalic acid until all the stain from the permanganate is gone; (5) dipped into a solution of bichloride of mercury (1 to 1000) for one minute. The hands are then dried with a sterile towel. A thorough scrubbing of the hands with soap and water and brush, and immersing the hands in a solution (1 to 1000) of bichloride of mercury for ten minutes, is quite sufficient, as a rule, for complete asepsis. Some surgeons are very careful in regard to the nails, and depend for sterilization of the hands upon scrubbing them very thoroughly with soap and water and brush, using no other antiseptic.

PREPARING THE PATIENT.—In all major operations, whether a general anesthetic is to be given or not, the patient should have a cathartic given the night previous to the operation, to be followed the next morning by a saline or enema if not effective. If the operation is to be performed at a hospital, the patient should be sent to the hospital the night previous to the operation to get accustomed to the

bed and surroundings. A full bath should be given the morning of the day of the operation. Just before the patient is brought to the etherizing or operating room the day clothes should be changed for nightclothes, over which a bathrobe or dressing gown is to be worn until the patient is placed on the operating table, when he should be covered warmly with a blanket. Special inquiry as to artificial teeth should be made, and the patient should be instructed to empty the bladder just before going on the table to avoid involuntary micturition. Where chloroform is given, the lips and nose should be greased with vaseline or cold cream to prevent blistering. Patients who are to have a general anesthetic given should have nothing to eat on the day of the operation, and not until some hours after the operation, and then only fluid diet, as tea, milk, and broth in small quantities at a time. This precaution on the part of the nurse is very important, because with solid food in the stomach vomiting is almost sure to come on during or immediately after the operation, and the patient's life is endangered from having some of the food lodged in the larynx. Furthermore, the success of the operation is greatly imperiled, especially if the eyeball has been opened. Even the contents of the eye may be extruded, if the vomiting is very violent, and the sight totally destroyed. In weakly patients a little clear broth or stimulant may be given three hours before the operation, but no solids under any circumstances should be given within the six hours preceding the operation.

The surgeon himself or an assistant makes a physical examination of the patient as to the heart, lungs, intestinal tract, some time before the operation; and also gives directions to the patient as to looking "up" or "down" just before the operation is begun.

Field of Operation.—In case the operation is on or near the eyebrow, this should be shaved before the patient is brought to the operating room. Placed on the operating table, the patient is covered with a blanket, and over this and well up under the chin is placed a rubber sheet. Towels should be laid over the pillow of the patient and over this a rubber sheet. On the patient's head is adjusted a sterilized rubber cap or towel to effectively keep the instruments and hands of the operator from contact with the hair. The skin about both eyes and the outer surface of the lids is now washed thoroughly with soap and water, the edges of the lids and eyelashes receiving special care. The skin surface may then be mopped in turn with alcohol and a solution of bichloride of mercury, 1 to 5000. The lids are now everted and the eye and *culs-de-sac* thoroughly flushed with warm sterile water or boracic acid solution squeezed from a pledget of cotton. Some operators wrap a little cotton on a cotton carrier, saturate it in the sterile water or boracic acid solution, and carry it along the *cul-de-sac* above and below to insure complete cleanliness. Some surgeons irrigate the eyes and *culs-de-sac* by means of a small rubber bulb fitted to a glass pipette, or the ordinary irrigation bottle with rubber tubing and a flattened glass tip is employed. In each instance the flattened glass tip is placed deep into the *cul-de-sac* (but the lids not everted) and the solution forced out of the rubber bulb gently; or allowed to flow out of the irrigation bottle for a few seconds. If this is used, care must be taken that the bottle should not be placed too high above the patient's head, lest the pressure be too great. Other surgeons direct that the nurse or assistant wash the eyes thoroughly the day before the operation, and bandage the eyes, which bandage is left on until just before the operation.

Unless there is some mucous discharge from the conjunctiva, no antiseptic solutions should be used on the eye itself as they are quite irritating; and, if there is any considerable discharge from the conjunctiva or lacrymal sac, no operation with a view of opening the eyeball should be undertaken until this discharge has been relieved by means of appropriate treatment. In case of septic operations, as abscess, antiseptic solutions may be used on the eye, such as bichloride of mercury solution, 1 to 5000, or formalin, 1 to 5000. The nurse will rarely be called upon to prepare the field of operation, most surgeons preferring to do this themselves or to have an assistant do it; but she may, and should be able and ready to do it as directed.

The anesthetic, if general, is usually administered by an assistant, but the nurse is occasionally called upon to do this in emergency cases.

Local anesthesia, described in a previous chapter, is produced by means of cocaine and holocaine, and is begun five to ten minutes before the operation begins, the nurse usually putting the first drop in the eye in the anteroom. The eye not to be operated upon, after cleansing, should have 1 drop of cocaine in it and a pad of moist cotton placed over it. This keeps the eye quiet, and the patch prevents the patient seeing every motion of the surgeon or assistants. And this leads me to remark that but few spectators should be allowed in the operating room, and entire silence must be insisted upon. I suppose it is unnecessary to say that nurses and assistants should not speak unless spoken to.

The Different Operations.

After preparing the operating room, table, instruments, dressings, and the patient for operation, it is the

nurse's duty to assist in the different operations, and to care for the patient and to assist in the dressings after the operation. The operations upon the appendages of the eye, lids, and lacrymal apparatus will be considered first, and later the operations upon the eyeball itself.

In the MINOR OPERATIONS, such as opening styes, opening and curetting chalazia, and passing lacrymal probes, no special preparations are required. For a *stye* all that is necessary is a bowl of hot boracic acid solution and a small bistoury, which should be sterilized. For a *chalazion* are required hot boracic acid solution, a small bistoury, chalazion curette, 4 per cent. sterilized solution of cocaine, and a hypodermic syringe sterile ready for use. The eye is washed with boracic solution. A few drops of a 4 per cent. solution of cocaine are dropped on to the mucous surface of the everted lid. After five minutes the lid is again everted and from 2 to 4 drops of a 1 per cent. solution of cocaine injected into the tumor by the surgeon. After eight minutes' wait the cyst can be opened and curetted without the least pain. The after care of styes and chalazia may be attended to by the patient himself, and consists in bathing the eye with hot boracic acid or salt solution.

OPERATIONS ON THE TEAR-PASSAGES.

For slitting the canaliculi and passing probes are required hot boracic acid solution, and, if pus is present, hot bichloride of mercury solution (1 to 5000), a tube of vaseline, cocaine, 4 per cent. solution (except in children and weakly patients, when a general anesthetic is given), a lacrymal knife, a full set of lacrymal probes, and where an abscess is present, a bistoury. All of the above are to be made surgically clean, of course. Except in the cases

where a general anesthetic is given, such cases require no special preparation, and are operated on in the outdoor department of hospitals and in the private office.

EXCISION OF THE LACRYMAL GLAND; THE LACRYMAL SAC; THE PLASTIC OPERATIONS ON THE EYELIDS, AS FOR ENTROPION (TURNING INWARD OF THE LID), ECTROPION (TURNING OUTWARD OF THE LID), AND PTOSIS (DROOPING OF THE UPPER LID).

These operations are usually performed with the patient under a general anesthetic. Here the patient must be prepared for the anesthetic and all arrangements for an antiseptic operation complied with. Antiseptic and sterile solutions are to be prepared, bichloride, carbolic, sterile water, plenty of hot water, absorbent cotton, pledgets or balls of cotton for sponging, bandages, gauze, strip gauze (plain and iodoform), iodoform and iodol powder, and the following instruments more or less varied according to the direction of the surgeon: a Beers knife, bistoury, scissors (straight and curved), fixation forceps (small and large), dressing forceps, retractors, hard rubber spatula, needle holder and needles, sutures, etc.

EXPRESSION; GRATTAGE.

The "expression" and "grattage" operations for trachoma are both performed under general anesthesia. After the patient is prepared the only instruments necessary in the first operation are two pairs of expression forceps, and, for grattage, a multiple knife and a stiff toothbrush. Solutions of hot, sterile water and bichloride of mercury (1 to 500) should be prepared; also plenty of cotton mops for sponging, a tube of vaseline, dressings, and a bandage.

Some operators put no dressing on the eyes after these operations, but have the nurse apply iced cloths frequently, thirty minutes at a time, for two or three days. The eyes are to be kept thoroughly cleansed with boracic acid solution several times a day, and when the surgeon comes to examine the case a stiff conical pointed probe (No. 8 Theobald lacrymal probe is excellent) should be at hand, with which he separates the folds of conjunctiva in the *culs-de-sac*. This is necessary because of the adhesions which take place after the above operations. A membrane forms on the lids within forty-eight to seventy-two hours after the above operations. The lids should be everted, if not too much swollen, and this membrane gently rubbed away with cotton wrapped on an applicator. This maneuver should be repeated daily until the adhesions and membrane cease to form.

TENOTOMY AND ADVANCEMENT.

Many times these operations are performed under a general anesthetic, especially in children, when the patient must be prepared in the usual way. When cocaine is used it is generally in 4 to 6 per cent. solution. The instruments necessary are: speculum, two fixation forceps (narrow and broad), and for the advancement operation some surgeons have a special forceps to hold the cut muscle (Prince, Reese), two tenotomy hooks, curved and blunt-pointed scissors, needle holder, and threaded needles. Solutions of boracic acid, or plain sterile water, oval patches of gauze and cotton, a roller bandage, and pledgets of cotton for sponging, complete the arrangement for the operation. During the operation the nurse will have little to do. Most surgeons in America bandage the eyes for from twelve to twenty-four hours, and some for four or

five days, changing the dressing daily. After the first day iced cloths are usually applied, three or four times a day, and the eye kept clean with boracic acid or other bland solution.

OPERATIONS ON THE EYEBALL WHEN THE EYE IS NOT OPENED.

Corneal ulcers are sometimes curetted, and then cauterized with pure carbolic acid (95 per cent.). The nurse should get ready a 4 per cent. solution of cocaine, a small curette, carbolic acid, a gauze pad, and bandage. Sometimes the actual cautery is used, when a spirit lamp and blunt-pointed probe are to be ready. Often the surgeon uses a Paquelin cautery or the galvanocautery; a solution of atropine (gr. iv to ℥j) should be at hand.

ENUCLEATION.

The patient must be prepared for a general anesthetic. The instruments required are large and small blunt-pointed, curved scissors, two fixation forceps, a tenotomy hook, and a speculum. In case of *exenteration* of the orbit a periosteum elevator must be had also. Solutions of bichloride of mercury, 1 to 5000, and boracic acid, saturated, and very hot water should be ready, also cotton sponges, plain, sterilized gauze in pads, and iodoform gauze and plain sterilized gauze in strips and bandages. In case of much bleeding the orbit is douched with hot boracic solution, or plain hot water, the orbit packed tightly with strip gauze, and a firm bandage applied. Should bleeding come on some time after the operation, the nurse should apply a bandage tightly over the other bandages, and if this does not control the bleeding the dressing should be removed,

the orbit washed with very hot boracic acid solution, packed tightly with gauze, and rebandaged tightly. Of course, this must be done under strict antiseptic conditions, and the surgeon notified. Sometimes great difficulty is encountered in removing the first packing from the orbit after an enucleation or exenteration.

If necessary, this packing should be soaked with hot boracic acid for half an hour rather than cause the patient great pain. This is done by removing the outer dressing and squeezing a small stream of the boracic acid solution from a pledget of cotton, holding the lids apart with the other hand. The dressings are changed daily for four or five days, when they may be discontinued, and an artificial eye introduced at the expiration of one week or ten days.

In the *Mules operation,* a substitute for enucleation, the front of the eye (cornea) is cut off; the contents curetted out to the sclera; a glass, silver, paraffin, or gold ball inserted, and the wound closed with many sutures. Fat from the patient's own body may be used to fill the cavity of the sclera. The additional instruments required are a Beer's knife or small scalpel, straight scissors, Mules's instrument for inserting the balls into the sclera, a sharp curette, glass or silver balls, and several threaded needles. Carbolic acid (95 per cent.) and alcohol (95 per cent.) should be provided. The strictest antiseptic precautions are necessary in this operation. Some American surgeons apply a firm bandage for twelve hours, followed by iced cloths, while others begin the application of iced cloths shortly after the operation. There is always intense reaction following this operation, redness of the lids; chemosis of the conjunctiva, protruding between the lids at times; redness, pain, and often rise of temperature.

The patient is always put to bed after an enucleation

or Mules's operation, is given fluid diet for twenty-four hours, and the temperature and pulse are charted at least twice a day.

OPERATIONS WHERE THE EYEBALL IS OPENED.

It may be stated here that in all operations where the eyeball is opened the strictest antisepsis and asepsis must be practised. Even in the simple operations of paracentesis and needling (keratonyxis), where but one or two instruments are used, just the same care must be exercised as in preparing for a cataract extraction. Tepid, sterile water and boracic acid solutions are the best for cleansing the eye where the eyeball is to be opened. Bichloride of mercury solution certainly should not be used after the eye is once opened, as it tends to cloud the cornea.

PARACENTESIS.

The instruments necessary for this operation are a narrow Graefe knife, a speculum, and fixation forceps. Warm boracic acid solution, 4 per cent. solution of cocaine, patches of gauze and cotton for each eye, a bandage, and narrow strips of adhesive zinc oxide plaster are to be made ready.

NEEDLING OPERATION.

For a needling operation, a knife-needle, fixation forceps and speculum, in addition to warm, sterile, boracic acid solution and dressings for each eye and a bandage, are required. In removing thick membranes from the pupil (membranous cataracts) it is necessary to open the eye as for iridectomy. The instruments required are: a speculum, fixation forceps, angular keratome, iris scissors, iris forceps,

and a narrow spatula or iris replacer. The pupil should be dilated with atropine before the operation, and a solution of atropine (gr. iv to ℥j) should be at hand for instillation immediately after the operation. Dressings for both eyes and a bandage are necessary.

SCLEROTOMY.

For sclerotomy, the instruments required are a cataract knife, fixation forceps, and speculum; and iris forceps and scissors may be needed, so should be ready. The same solutions and dressings are necessary as for the needling operation.

IRIDECTOMY.

For iridectomy, the same solutions and dressings are necessary as for sclerotomy, but more instruments are required. In addition to the speculum, fixation forceps, and narrow spatula (iris replacer), an angular keratome is usually preferred to the Graefe knife; iris forceps and iris scissors are also needed. After sclerotomy or iridectomy is performed for glaucoma a sterile solution of eserine (gr. ij to ℥j) or pilocarpine (gr. iv to ℥j) should be on hand for instillation into the eye immediately after the operation.

OPERATION FOR EXTRACTION OF SENILE CATARACT.

The patient should be sent to the hospital the afternoon previous to the day of the operation, that the patient may become accustomed to the bed and surroundings, the bowels opened with a cathartic, and the morning of the day of the operation a general bath given. If a general anesthetic is to be given, which is rarely the case, the patient should fast for at least six hours before the time for the operation. Even where cocaine is employed as the anes-

thetic, which is usually the case, the stomach should be empty or only liquid food given, and this not nearer than three hours before the operation. Vomiting may be caused by the shock of the operation, and a full stomach may be put down as a predisposing cause. Of this I have had sad experience in one case of cataract extraction at a private house. The lady was given the usual instructions as to the bath and cathartic the night previous to the operation, and was told to eat a very light lunch at 12 o'clock (operation to be at 3 P.M.). Instead of eating a light lunch she ate very freely and took some brandy to fortify her nerves. Immediately after the extraction, and before the bandage could be applied, she began to vomit, continuing for some half-hour, the bandage being applied in the meantime as well as possible. On inspecting the eye the next day the retina was found detached and protruding from the wound. I cite this case to emphasize the necessity of taking every precaution to insure quiet and rest during and after the operation in cases where the eye is to be opened. The instruments required are: speculum, fixation forceps, Graefe cataract knife, cystitome, Daviel spoon, shell spoon, iris replacer or spatula, wire spoon or vectis, iris forceps, and iris scissors. Some surgeons have in readiness also a suction syringe (Teale's) or irrigating tube (Lippincott's), in case of much cortical matter, to assist in its removal. Warm solutions of boracic acid (saturated), sterile water, normal salt solution, and a 4 per cent. solution of cocaine, all sterile, should be freshly prepared. Cotton balls for sponging, oval eyepads (cotton between layers of gauze), bandage, strips of adhesive zinc oxide plaster, and eyeshield (Ring's) should be in readiness. The instruments should be on a tray by themselves, while the dressings should be on a separate tray. A double-shelved table may

hold both and the necessary solutions, or a second small table may be required. Just before and during the operation the nurse should be ready to hand the surgeon the cocaine solution, or bowls containing the cleansing solutions, cotton balls, etc. Immediately the section is made, the knife should be taken in charge by a nurse and cleansed and dried, not allowing it to be knocked about with the other instruments. After the operation the nurse is to hand the tray with the dressings to the assistant, and, when both eyes are bandaged (even if but one is operated on) and the shield applied, is to assist in getting the patient off of the table and into the bed with the least possible straining or jarring of the patient. In bed the patient is to be placed on his back, or on the side opposite to that operated upon, quiet enjoined, and the patient warned not to pick at the dressing or to move for anything whatsoever, but to call the nurse when anything is wanted. In a private case the nurse will be by the patient's side most of the time, but in a ward an electric push bell, the handle of which is attached by a cord to the bed and the patient's hand placed on it to show him where it is, serves to call the nurse for every want, as for a drink, to turn in bed, the urinal or bedpan, etc.

In the author's opinion it is a good plan to give the patient an opiate the first night following a cataract extraction. This usually assures a good night's rest and enhances the chances for smooth and early healing of the wound.

CHAPTER IX.

AFTER-NURSING OF THE DIFFERENT OPERATIONS ON THE EYE.

Plastic Operations—Operations on the Eyeball—Operations where the Eyeball is Opened: Paracentesis; Needling; Sclerotomy; Iridectomy; Extraction of Senile Cataract—Complications: Delayed Union of the Wound; Infection; Iritis; Entropion; Shock; Vomiting; Delirium.

It is in the management of cases after operations, especially in private cases, that the ability and capability of the nurse is thoroughly tested. In carrying out instructions she must be resourceful, but tactful; gentle, but firm; never losing her temper, but ever patient, bearing in mind always that she is dealing with sick people. Truly efficient nurses, like poets, it may be said, are born, not made. Training may do wonders for her as far as arranging for and assisting at operations and nursing in a hospital ward, but for private nursing, to be successful, there must be an innate aptness not furnished by any amount of training. Many nurses, in fact, shrink from this work just on account of the difficulty of "managing" such patients.

Plastic Operations.

In the various plastic operations upon the eyelids and especially where a general anesthetic has been given, the nurse is to accompany the patient to the ward or private room, as the case may be, and remain by the bedside until the patient is out from under the influence of the anes-

thetic. In cases of children who have a tendency to pull off the dressings their hands should be tied to the sides of the bed. Unless there is some complication, as shock, hemorrhage, vomiting, etc., which will be spoken of later, the nurse's chief duty for the first twenty-four to forty-eight hours is to see that the patient gets the proper diet at the right time and sufficient rest and is not allowed to suffer too much pain. Where both eyes are bandaged, the patient must be fed by the nurse and assisted with the urinal and bedpan, unless the patients are able to walk, when they are to be led to the closet and back to the ward or room. After a general anesthetic no solid food should be given for at least four hours, but hot soups, broth, or milk may be given in limited quantity, and *a little at a time,* two hours after the operation, and repeated in from one-half to one hour if the first amount is retained. There should be no hurry about feeding the patients after an operation, even with "slops" unless the patient is very weak. The nurse should also be very careful how she gives water to patients shortly after general anesthetics have been administered, although the patients may be very thirsty. The best plan is to let them suck small pieces of ice. After the first twenty-four hours semisolid food may be given, as eggs, oatmeal, and mush; and after forty-eight hours usually a solid diet may be given, unless there is some contraindication, in which case the surgeon directs just what is to be given and what not. The pulse and temperature should be charted for a few days, especially when there is any febrile reaction. The bowels should move on the second day after the operation.

In all *redressings* following operations the nurse is to be just as careful in her antiseptic and aseptic methods as when preparing for the operation. In the first place, all

bowls, basins, solutions, and dressings must be strictly aseptic, as must also all dressings, forceps, or other instruments to be used in redressing the cases and for removing stitches. And, of course, the nurse's and the attendant's hands must be aseptic.

The after-nursing of operations upon the eyeball where the anterior chamber has not been opened has been indicated already in Chapter VIII under the description of the different operations themselves, and need not be repeated here.

Operations where the Eyeball has been Opened.

In simple paracentesis of the cornea the after-care is usually very simple. The wound, being small, is healed at the first inspection. Of course, all antiseptic and aseptic precautions are to be observed in redressing the wound. Two or three dressings, consisting of an oval gauze and cotton pad, held in position with strips of plaster, are all that are required.

The needling operation for membranous cataract following the extraction of a senile cataract, if no complications ensue, requires but little after-care. The eye is inspected daily after the operation, the dressings (patch and adhesive strips) changed under strict antiseptic precautions, and a drop of a solution of atropine (gr. iv to ℥j) is instilled. The patient may be confined to the house for four or five days before being discharged. Usually smoked glasses are worn for a few days, if the eye is sensitive to light. Where needling is done to remove soft cataract in the young, the eye is inspected daily, the dressings changed under strict antiseptic precautions, and a drop of atropine instilled. If all goes well the patient is ready to leave the hospital in five or six days' time. Occasionally after

needling a soft cataract the lens swells so rapidly that it causes marked plus tension or hardening of the eyeball, accompanied by intense pain in the eye and redness of it; that is, it produces secondary glaucoma. Where the pain persists and the tension of the eye remains much elevated, the surgeon usually performs linear extraction of the soft cataract, for which see below.

After the operation of sclerotomy and iridectomy usually both eyes are bandaged, and the patient put to bed for a few days and fed on slops for the first day. Great care is taken to prevent the patient from straining or exerting himself in any way. The eye is inspected under the strictest antiseptic precautions daily, and the dressings reapplied. If the operation has been performed for the cure of glaucoma, as is often the case, a sterile solution of eserine (gr. ij to ℥j) or of pilocarpine (gr. iv to ℥j) should be in readiness to be instilled at each dressing.

After-care of Operations for Senile Cataract.

The after-treatment of cataract operations varies somewhat with different surgeons. As a rule, however, both eyes are closed after the operation with oval cotton or cotton-wool pads, inclosed between a single layer of gauze on either side of the cotton, which are held in position with narrow strips of adhesive zinc oxide plaster. Over this, most ophthalmic surgeons place a roller bandage (of flannel or gauze 1½ inches wide) to make the dressing more secure, and the whole is covered with a shield to prevent injury to the eye. Some surgeons use simply the pads held in position with adhesive strips, and over this a protective shield; others have advised a strip of isinglass plaster (1 by 1½ inches) to close the lids with, and no other dressing; while

a few surgeons use no dressing whatever on the eye. In my opinion, without question, after cataract extraction, a dressing of some kind affording support and protection to the eye during the healing process should be used. The oval pads on each eye, held in position by strips of adhesive plaster and protected by a Ring *papier maché* mask is about the best dressing, and I believe it to be a good practice to place a bandage over the pads on both eyes before the mask is applied. The objection to the bandage that it causes "dragging" on the dressings is overcome by strips of adhesive plaster which hold the dressings (pads) in position.

The patient is placed in a moderately lighted room in bed and on his back or on the side opposite to the eye operated upon. He should stay in bed at least twenty-four hours, and it is better to have him remain in bed two or three days until the wound is healed, after which he may be allowed to sit up in an armchair for part of the day, or all day, if he is more comfortable sitting up. When confined to bed the urinal and bedpan should be used. If the bowels do not move on the third day after the operation an enema of warm water and soapsuds should be given. The patient should be cautioned not to strain at stool, as great harm can result to the eye as a result. The diet should be fluid for the first day, and semisolid the next two or three days, after which the usual diet may be given, with care not to overfeed, or upset the stomach. Mild stimulants may be required in some cases, especially if the patient has been accustomed to them. The nurse must feed the patient as long as both eyes are bandaged. Highly seasoned foods, and fruits and pastries, except in limited quantities, are contra-indicated.

For the first few days after extraction of senile cataract there is usually some smarting and burning in the

eye and a "sore feeling" complained of, but not a sharp or aching pain. This wears off in three or four days' time, and the patient is able to rest. If these symptoms continue and the patient is unable to sleep an anodyne should be given. If a shooting or decidedly hard pain should persist, the surgeon should be notified, the dressing removed, and the eye inspected and redressed. Sometimes a faultily applied bandage, or an eyelash loosened and caught between the lids, may cause the pain, or, if a simple extraction has been performed, a prolapse of the iris into the wound may cause acute pain. Acute persistent pain demands inspection of the eye and redressing, even within five or six hours after the operation. If all goes well, however, the first dressing should not be made until twenty-four hours after the operation, some surgeons waiting two or three days before making a change. If a simple extraction is done, that is, without iridectomy, the dressing should be changed in twenty-four hours, and the eye looked at to see if any prolapse of the iris has occurred. The lower lid is pulled gently downward, a little warm, sterile, boracic acid solution squeezed from a pledget of cotton into the eye, the lower lid and face bathed with the same solution, and the eye bandaged. The dressings are to be changed daily under the strictest antiseptic precautions, especially until the wound is healed. On the third day after the operation, most surgeons, instill a drop of atropine into the eye, and repeat the instillation daily until the eye is quiet and white. Both eyes are kept closed for five or six days, when the unoperated eye is left uncovered and protected by a double shade covering both eyes. About the sixth or seventh day all dressings may be left off and the eyes protected with a shade or smoke-coquilles. From the tenth day the patient may be allowed to take a little exercise out of doors.

The foregoing description applies to the normal, uncomplicated course of healing following extraction of senile cataract. Several complications, both of a local and a general nature, may occur to interrupt and retard the healing process or even jeopardize the success of the operation altogether.

LOCAL COMPLICATIONS.

First, the local complications which may ensue will be considered in turn; they are: delayed union of the wound, infection of the wound, iritis, deep infection, panophthalmitis, meningitis by extension, pseudo- or false erysipelas from atropine, etc.

Delayed union of the wound may result from improper apposition of the wound surfaces, or from lack of nutrition in old or debilitated patients, and at times without any apparent cause. Where apposition of the wound surfaces is not good the surgeon readjusts them, and, in the cases due to lack of nutrition, tonics and concentrated fluid diet are resorted to. The eye must be kept bandaged until the wound closes, even if it is as long as two weeks, the dressings being changed infrequently; that is, at two or three days' interval; so as not to disturb the wound any oftener than is absolutely necessary.

Infection of the wound is manifested by pain, lacrymation, and more or less muco-purulent discharge from the eye. In such case the simple eyepad held in position with adhesive strips and covered with the Ring protective shield, which can be removed readily, is the best dressing. The eye should be inspected two or three times during the day, bathed with hot boracic acid solution, and atropine instilled. The surgeon usually cauterizes the wound with pure carbolic acid, the galvanocautery, or the actual cau-

tery, any one of which the nurse should have in readiness according to the direction of the surgeon. A local application of a 50 per cent. solution of argyrol has proved of great service in some of the cases, and it has the advantage of being non-irritating. A 4 per cent. solution of cocaine should be ready for producing local anesthesia before cauterization is done. Dusting the wound with iodoform is of benefit in some cases.

Deep infection of the eye may extend from the wound infection, or occur within the eye while the wound heals. It is manifested by severe pain, cloudiness of the aqueous humor, discoloration of the iris, pus in the anterior chamber perhaps, and marked redness of the eye. If not checked, the conjunctiva becomes chemotic, the eyelids swollen and edematous, all of the tissues of the eyeball become inflamed, and there is excruciating pain, with intense suffering, accompanied by rise of temperature, rapid pulse, and at times with vomiting. Cases of death from meningitis by extension of pus from the eye to the meninges have been reported.

Where infection occurs deep in the eyes, the symptoms (which may not be present till the third or fourth day after the operation) indicate to the house surgeon that a serious complication is taking place. This should be reported at once to the surgeon. When certain that infection has taken place, the wound should be opened, the anterior chamber irrigated with a warm, sterile, salt solution, the edges of the wound cauterized, atropine instilled, and hot fomentations applied for twenty minutes every two hours. Some favorable results have been reported where the infection has been checked and the eye saved by injecting a few drops of a 25 per cent. solution of argyrol into the anterior chamber (Webster). Where the inflammation results in a

panophthalmitis (all the tissues of the eye becoming involved), poultices must be applied, anodynes given, the wound opened and irrigated with antiseptic solutions, and the patient made as comfortable as possible.

The nurse will find plenty to do in infected cases in keeping sterile solutions and dressings on hand, in cleansing the eyes, or assisting, and in making hot applications. Antiseptic precautions are to be observed, of course.

Infection of the eye may result from the needling operation for membranous cataract. In fact, infection is more apt to occur after a needling operation than after the primary operations, if antiseptic methods are not rigidly followed. Germs carried into the eye with the needle remain in it, the opening made by the needle being so small they cannot easily escape; whereas, after section of the cornea, germs, if not too many are introduced, may be washed away by the aqueous humor and by irrigation with sterile water or boracic acid solution. It is altogether essential, therefore, that the needle be absolutely aseptic, and, for that matter, all other instruments connected with the delicate operation for needling.

Iritis.—This complication may be of a very mild nature, accompanied with but little or no pain, redness, or irritation, yet of sufficient intensity to cause adhesions to form between the iris and the remains of the lens capsule. To obviate this, most surgeons instill a drop of atropine into the eye on the third day after the operation and for a few days following. This dilates the pupil and prevents the adhesions.

Severe iritis of an exudative nature sometimes follows extraction of senile cataract, especially if the iris has been bruised at the time of the operation. It usually manifests itself on the third or fourth day following the operation by

redness of the eyeball; pain of a severe nature, worse toward night; lacrymation; discoloration of the iris; contraction of the pupil, and an exudate may be thrown out blocking the pupil. In such an unfortunate complication the nurse will be required to apply leeches to the temple, change the dressings several times (three or four) during the twenty-four hours, to apply hot, moist fomentations to the eye, and at the same time to instill a drop of atropine solution (gr. viii-xij to ℥j) into the eye. The bowels should be opened thoroughly with calomel and soda, or some other cathartic. At times, sweating the patient freely seems to give relief. The patient must be kept on fever diet.

Sympathetic inflammation of the fellow-eye may follow the operation for the extraction of senile cataract, especially if the iris or lens capsule is caught in the wound and retained there during the healing process. It is truly an unfortunate complication and often results in total blindness. Its symptoms and method of treatment have been described previously (see page 57).

Hemorrhage may follow the operation of iridectomy for glaucoma, or operation for cataract, and is always a most serious complication, the sight many times being lost as a result. It occurs most frequently in arthritic patients and those with high blood-pressure, usually without warning, and little can be done to prevent it. Bleeding may take place from one of the iris vessels or from some of the deeper vessels in the eye. It has a tendency to occur in glaucoma. If a sharp and intense pain strikes the eye suddenly a few hours after the above operations, especially if accompanied by nausea and sickness at the stomach and depression, the nurse should report such facts at once to the surgeon or assistant. Removal of the dressings may show

them to be wet with blood, or the blood may be clotted between the lids or in the lips of the wound itself. The blood-clots should be removed, very hot wet compresses applied for a while, to try to stop the hemorrhage, and a compress held firmly with a roller bandage applied. The patient may be propped up in bed, perfect quiet enjoined, and sedatives may be administered by direction of the surgeon. Whatever is done the eye is usually lost through infection, or later by shrinkage of the globe.

Spastic entropion (turning inward) of the lower lid is an annoying complication occasionally following operations on the eyeball. Painting the skin surface of the lid and the face just below the eye with flexible collodion gives relief many times. If this is not effective, a stitch placed in a vertical direction through the skin of the lid and cheek and tied firmly usually gives the desired effect.

GENERAL COMPLICATIONS.

Complications of a general nature which may follow operations on the eye and its appendages are: shock, vomiting, and delirium.

Shock as a complication after ophthalmic operations is rare. It should be dealt with as after other operations, the patient put to bed, hot-water bags applied to the feet and sides, and stimulants given.

Vomiting following operations upon the eye where the eyeball has been opened is a very undesirable complication and one to be avoided if possible. Before the discovery of the anesthetic properties of cocaine by Koller, when these operations were performed with the patient under the influence of a general anesthetic, especially after ether, vomiting was a frequent complication. Thanks to the genius of

this great man, we have been given the boon of a local anesthetic, after the use of which the patient is freed of pain during the operation, and the dangerous complication of vomiting made much less frequent than after ether or chloroform anesthesia, to say nothing of the danger to life from the exhibition of the latter two.

At the very first indication of sickness at the stomach or nausea, the patient should be placed flat on the back, if not already in that position, all pillows removed from the head, and a mustard leaf applied to the stomach. A teaspoonful of hot water, tea, or coffee sometimes allays the trouble, or even a small piece of ice in the mouth may be of service. Many, many remedies have been advised for vomiting, and any one of these, according to the direction of the surgeon, may be given. During the paroxysms of vomiting the patient's head should be supported by the nurse, taking care not to disturb the dressings any more than can be helped. If the dressing should be soiled, the outer bandage may be removed and fresh dressings applied.

DELIRIUM, leading at times into *acute mania,* sometimes follows operations upon the eyes, particularly after the operation for the extraction of senile cataract and iridectomy for glaucoma where both the eyes are bandaged and the patient thus placed in total darkness. It is usually manifested in from twenty-four to seventy-two hours, but it may be four or five days after the operation. The patient becomes restless, with inclination to talk, or laugh or cry perhaps; sometimes terror or fright seizes the patient, and he imagines some one is trying to injure him. With such symptoms coming on, the nurse should notify the surgeon at once, and remain constantly by the patient's side to prevent him from tearing off the dressings, injuring the eye or perhaps himself. In many instances freeing one eye

(the unoperated one) gives entire relief. At times both eyes may have to be freed, and if this does not give relief, it may be necessary to use force in restraining the patient. If in a hospital, the patient should be allowed to return home at the earliest possible moment. Sometimes the familiar surroundings of home assist in clearing up the hallucinations and illusions of the patient.

Where the patient becomes violent and delusions are present, sedatives, such as opium, bromides, etc., should be given. Until the wound is entirely healed the nurse must be constantly in attendance.

CHAPTER X.

DRESSINGS, BANDAGES, SHADES, PATCHES, PROTECTIVE SHIELDS, PROTECTIVE GLASSES, AND ARTIFICIAL EYES.

Antiseptic Dressings—Bandages—Application of Roller Bandages—Special Bandages—Masks and Shields—Redressings—Shades and Protective Glasses—Artificial Eyes.

DRESSINGS.

THE nurse will be called upon to prepare many of the dressings, bandages, and shades used about the eyes, and for that reason should be ready and able to do such work when it is necessary. All dressings to be used about the eyes should be aseptically clean, while some of the dressings are rendered antiseptic by being impregnated with antiseptic remedies, such as bichloride of mercury, carbolic acid, iodoform, etc. Dressings for the eyes are needed chiefly after operations upon the eye, to support and protect the wound and to keep it free from septic material. They are required at times in the treatment of diseases of the eyes. For example, in detachment of the retina, the pressure bandage is used to promote absorption of the fluid beneath the retina. It is also used to promote absorption of inflammatory material in the lids, or to prevent swelling of the lids, as after the operation of expression in trachoma, or after the Mules operation. Or a dressing may be used to support the cornea and prevent its rupture when thinned by ulceration; or, when thinned by malnutrition, to prevent staphyloma or conical cornea, etc.

The materials of which eye dressings are made are absorbent cotton, cotton wool, gauze, or cheese cloth prepared

in such way that they are absorbent. They may be sterilized and used plain or impregnated with some antiseptic material, as stated above.

For convenient use on the eye the cotton and cotton wool and gauze are cut into oval pads or patches about three inches long by two inches wide. The cotton as it comes prepared in the rolls from the druggist is in layers of from ½ to 1 inch in thickness. Thin patches may be made from a single layer of this, or, if the surgeon wishes, they may be made of two layers. On each side of this patch of cotton or wool is placed a single layer of gauze of the same size as the cotton patch. This prevents the cotton or wool fibers from getting into the eye or the wound itself. In hospital operating rooms a great number of these patches are prepared, sterilized, and stored in dust-proof glass jars.

Pads of several thicknesses of gauze, cut in the same shape and size as the above, are preferred by some surgeons. Again, pads of gauze, 8 inches long by 4 inches wide, with a notch cut in one edge for the nose, form a very convenient dressing when both eyes are to be covered, especially after plastic operations upon the eyelids or about the orbit. Over this wide pad is placed loose gauze to level out the depressions over the orbits so as to give uniform pressure and support to the wound.

For packing the orbit and for drainage purposes, the gauze is cut into narrow strips, 1 inch wide by 3 yards long; this may be left plain or it may be impregnated with iodoform, aristol, or other antiseptic remedies. This strip gauze is sterilized and packed snugly in test tubes and sealed ready for use.

The best way to sterilize plain dressings is to place them in a hot-air sterilizer (temperature, 300° F.) for one

hour. The receptacle for storing them may be treated in the same manner, or scalded with boiling water and later washed with a solution of carbolic acid (1 to 20) and dried, when they are ready for use. The bandages for holding these dressings on the eye should be sterilized in the hot air

Fig. 13.—Oval Eye Patch held on by Strips of Plaster.

at the same time as the dressings. Dressings thus prepared are thoroughly aseptic, and, except in septic cases, are preferable to dressings incorporated with antiseptic materials, which latter are apt to prove more or less irritating.

Where the oval eyepads are used, which are the most widely employed of all dressings for the eye, they should be held in position on the eye by two narrow strips, ½ inch by 4 inches long, of adhesive zinc oxide plaster for each pad. The strips are put on in a vertical direction extending from

the brow down and slanting slightly outward to the cheek below (see Fig. 13). This zinc plaster is prepared antiseptically and comes in convenient narrow rolls. Plain, adhesive plaster should not be employed, as it often causes irritation of the skin. Over this pad and strips of zinc plaster a bandage should be applied. If the zinc plaster strips are not used, the bandage is applied directly over the dressings. In my opinion the strips should be used in every case where the eyepads form the dressings, for they prevent the pads from slipping or becoming displaced and at the same time obviate the "dragging" of the dressings by the bandage. These two advantages outweigh by far the small disadvantage and annoyance of removing the plaster. If the patient is warned and the plaster gently removed (using a little ether if necessary in very nervous or sensitive patients, which renders the process absolutely painless) most patients do not complain. But, even if they do, a little annoyance with the chance of a good result is much to be preferred to entire comfort and the risk of a bad result.

ANTISEPTIC DRESSINGS.

These are made from the sterilized plain dressings by incorporating into them antiseptics of various kinds, as iodoform, carbolic acid, bichloride of mercury, or others, according to the desire of the surgeon.

Bichloride Gauze.—Impregnate absorbent gauze with a solution of bichloride of mercury 1 to 1000 containing 10 per cent. of glycerine. Wring it out, roll it up, and put it up in paraffin paper. The addition of the glycerine renders the gauze less irritating. It is well to tint the solution with fuchsin, as this enables the manufacturer to note whether the solution has been distributed uniformly throughout the gauze.

Iodoform Gauze.—Dissolve 4 parts of iodoform in 16 of ether. Then add 16 parts of alcohol, 2 parts of tincture of benzoin, and 2 parts of glycerine. To make a 10 per cent. gauze: weigh out 100 parts of the above solution, which contains 10 per cent. of iodoform; also weigh out 88 parts of gauze, and make the latter absorb the whole of the former. On drying, the gauze will retain the 10 parts of iodoform and the 2 parts of glycerine, and it will therefore be a 10 per cent. iodoform gauze.

Carbolized Gauze.—This is prepared in the same manner as the bichloride gauze. The strength of the solution used should be 1 to 40.

Borated Gauze.—Saturate the gauze with a 10 per cent. solution of boracic acid, made with boiling water. Tincture of benzoin is added to this solution to make the medicament adhere more firmly to the gauze. It is important to hang the gauze up in a horizontal position, as in any other position the solution would be apt to drain off unevenly.

An antiseptic dressing may be made by applying an ointment, made from any one of the above remedies, to the plain gauze, or directly on the wound. For example, 1 to 5000 bichloride of mercury vaseline, 10 per cent. iodoform vaseline, 1 per cent. carbolized vaseline, or 3 per cent. borated vaseline. Or iodoform, aristol, boracic acid, etc., may be dusted on the eye or wound and a plain dressing put over this.

BANDAGES.

The materials for bandages are gauze, flannel, and white and unbleached muslin. The width commonly employed is 1½ inches, and the length varies from 3 to 5 yards. Several bandages may be made at once by having

the material the requisite length, nicking the end at 1½ inch distances, and pulling the alternate strips in opposite directions. These strips are rolled by hand or machine into a firm, even, neat roll, freed of shreds, and covered with a protective paper to keep them clean.

An excellent material for bandages is a loose-woven muslin known as "water dressing," which may be had bleached or unbleached. It is very elastic, free from shreds, and conforms smoothly and neatly to the dressing and the head. It is used exclusively by some surgeons in this country. All bandages should be sterilized by dry heat (300° F.) for one hour before they are used.

APPLICATION OF ROLLER BANDAGES.

The art of properly applying a roller bandage to the eye; so that it will protect and support the wound or produce even pressure, as the case may be; so that it will stay on; so that it will look neat; requires no little practice. The nurse should practise the single and double roller and the figure of 8 bandages, for one and for both eyes, many, many times on a healthy subject before trying to apply them on a patient.

To apply the single roller bandage to one eye—for example, the right—the nurse, standing in front of the patient, holds the free end of the bandage on the middle of the forehead with the thumb of the left hand, while she makes a complete turn round the head, going from right to left (patient's) just above the ears, covering the free end as she brings the bandage across the forehead. The bandage is continued half round the head again, but a little lower than on the first turn, so that it comes under the occiput and under the right ear and up over the right eye to the center

of the forehead, where it may be fastened with a safety pin and the remainder cut off. This is a very convenient bandage, as the end that comes up over the eye may be unpinned, the dressing removed, the eye examined and redressed, and the end brought up and again pinned (if unsoiled) without disturbing the patient even to move his head from the pillow

Fig. 14.—Single Roller Bandage.

(see Fig. 14). Where the left eye is to be bandaged, the free end of the bandage is held with the thumb of the left hand, but the bandage is carried from left to the right (patient's) round the head, half round again and under the occiput, under the left ear, and up over the left eye to the center of the forehead and fastened with a safety pin. Where both eyes are to be covered with a single roller, instead of cutting off the bandage when one eye is covered, after the safety pin is fastened at the center of the fore-

head, the bandage is reversed and carried downward in front of the other eye and under the corresponding ear, under the occiput, and forward above the opposite ear to the center of the forehead. A second complete circular turn is taken around the head and the bandage fastened in front with a second safety pin (see Fig. 15).

Fig. 15.—Double Roller Bandage.

To apply the figure of 8 bandage to one eye (right eye), the free end of the bandage is held on the center of the forehead with the left thumb and the bandage carried to the left (patient's), making one complete turn round the head just above the ears; the bandage is then continued round the head on a little lower level under the occiput and under the right ear up over the right eye to the forehead; a second circular turn of the bandage is taken round the head directly over the first circular turn; then a second

diagonal turn is made, the bandage being a little higher (½ inch) on the side of the head above the ear on the left side, slanting down under the occiput, coming forward under the right ear and up over the right eye, on a little lower level (½ inch) than the first lap, to the forehead. A third circular turn may be taken and also a third diagonal, this time being ½ inch higher on the left side of the head

Fig. 16.—Figure of Eight Bandage for one Eye.

than the previous turn, slanting down under the occiput under the right ear and ½ inch lower on the right eye than the former turn, to the forehead; then a fourth circular turn is taken to make the bandage entirely secure (see Fig. 16). Safety pins are used to fasten the bandage: one at the center of the forehead, one above the left ear, and one below the right ear. Instead of safety pins, inch strips of adhesive plaster, 2 inches long, may be used for this pur-

pose. Only slight tension on the bandage should be used when the diagonal turns are made, but enough tension should be made on the circular turns to hold the bandage well in position. If the left eye is to be bandaged the bandage should be carried from left to right (patient's), or in the reverse direction to what was followed in bandaging the right eye.

Fig. 17.—Figure of Eight Bandage for Both Eyes.

To apply a figure of 8 bandage to both eyes, a circular turn of the bandage above the ears as for a single eye is first made, then the first diagonal turn as for a single eye (say, the right), then a second complete circular turn is made; then the roller should be carried down over the left eye, under the left ear, and up under the occiput, slanting upward above the right ear to the center of the forehead. A third circular turn is now made, then a second diagonal

over the right eye, a fourth circular, a second diagonal over the left eye, and so on, the circular turns alternating with the diagonal ones (see Fig. 17). Safety pins, or, preferably, strips of adhesive plaster, are used to fasten the bandage, at the center of the forehead and at each side of the head. If well applied, a single pin at the center of the forehead suffices to hold it on.

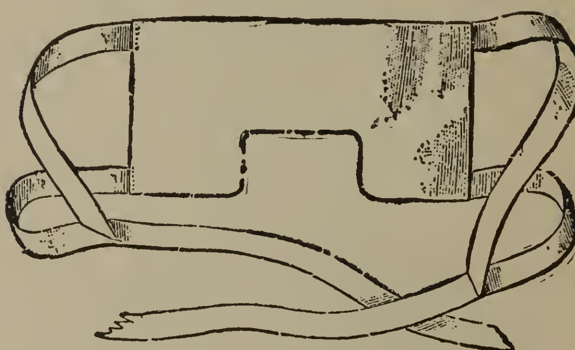

Fig. 18.—Moorfield's Bandage.

SPECIAL BANDAGES.

A number of special bandages for the eyes have been devised, the most useful of which are the "Moorfields," Stephenson's "dumb-bell," and von Alt's "strips." The Moorfields bandage (see Fig. 18) consists of a double fold of linen, rectangular in shape, 8 inches long by 3 inches wide, out of one edge of which a notch is cut so that the bandage will fit over the nose and eyes snugly. To each corner is sewed a tape; the tapes on each end are brought together so as to form a loop, leaving one free end of tape, however. When the bandage is in position the loops of tape

fit over the ears, while the free ends are carried beneath the occiput behind and brought forward and tied over the forehead.

The Stephenson[1] dumb-bell bandage, according to the author, "can be made in a few minutes from a piece of Saxony flannel or domette. As shown in the figure (Fig. 19), its shape resembles a dumb-bell, the handle of which passes over the nose, while the expanded ends fit over the

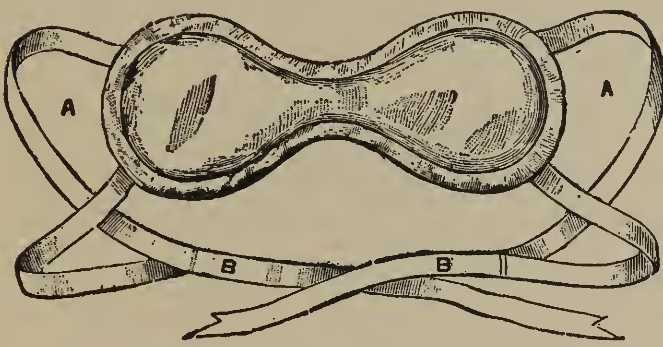

Fig. 19.—Stephenson's Dumb-bell Bandage.

eyes. This covering piece is fitted with two tapes, an inch in width, which are passed above the ears and round the head, to be tied together on the forehead."

Von Alt's strips are really not bandages, but are used for the same purpose as the narrow strips of zinc oxide plaster to hold the dressings from slipping or becoming disarranged on the eye, while a bandage is placed over them just as over the adhesive strips. They consist of narrow strips of cheese cloth, $1\frac{1}{2}$ inches in width by 5 or 6 inches in length, which are placed diagonally over the eyes, from

[1] "Ophthalmic Nursing," second edition, page 111.

the right frontal eminence across the left eye to the left cheek, from the left frontal eminence across the right eye to the right cheek. The ends are fastened to the face by means of adhesive plaster or zinc oxide plaster. These "strips" possess no special advantage over the simple narrow strips of zinc oxide plaster and are not so easily managed.

In children and unruly patients, after the ordinary roller bandage is applied, a few turns of a moistened starched bandage applied over it, or a bandage soaked in a solution of silicate of potassium or soda (40 per cent.), known as "water glass," and wrung out, may be used. These harden when dry and effectually hold the dressings in position and also protect the eye.

The *tie-patch* is made of an oval piece of brown paper, 3 by 2 inches, covered on each side with black silk. To each end a tape is sewed. This patch is very convenient for holding temporary dressings (an eyepad) on the eye after removal of cinders from the eye or after slight injuries.

Masks and Shields.

Numerous masks or shields have been devised to place over the eye and dressings after operations upon the eye, to give greater security, where the anterior chamber has been opened, as after extraction of cataract. The shield protects the eye from rubbing by the patient or accidental knocks, especially at night when the patient is half asleep and does not know just what he is about.

Ring's mask (Fig. 20) is the best of all the masks or shields with which I have had any experience. It is made of *papier maché,* about 8 inches long by 4 inches wide, is lined on the inside with white muslin and on the outside

with black muslin. It is shaped to fit the average sized nose, and protuberances come forward in front of each eye so as to give space for dressings. At each corner tapes are sewn, longer on one end of the mask, so that they may be carried round the head one above and one below the ear and tied on one side of the head. If it is desirable for the patient to see with one eye, a piece can be cut out of the mask

Fig. 20.—Ring's Mask.

directly in front of that eye. Where no pressure or support is to be made on the eye, the eyepads may be held in position with the strips of zinc plaster, and this mask placed directly over these. It thus takes the place of a bandage, leaves the eyes cool, and gives security at the same time. This mask has many advantages: it is light, comfortable, cool, and cheap (costing but 25 cents), and is destroyed when soiled or the patient is well.[1]

[1] They may be had of E. B. Meyrowitz, of New York City.

McCoy's shield (Fig. 21) is made of wire in two circular frames, held together by a loop and shaped somewhat like a rat-trap, the bases being about 3 inches across. It

Fig. 21.—McCoy's Shield.

can be made aseptic by boiling. It is applied over the eye dressings and held in position by means of tapes.

Stephenson's wire gauze shield is made in three sizes; it is pliable, and can be molded to fit the face and dressings. It takes the place of a bandage and is useful for protection in case of children or restless patients to prevent them from

pulling off the dressings. It is held in position by means of tapes, which are attached to eyelets at the ends of the shield. It can be made aseptic by boiling.

Andrews's aluminum shield is made of thin sheet aluminum, is about 3 inches in diameter, concave in shape, and can be bent somewhat to fit the dressings. It is applied

Fig. 22.—Andrews's Aluminum Shield.

over the bandage and held in position by means of tapes, as shown in Fig. 22. By dipping in boiling water it is made aseptic. Emerson has devised a shield of a similar nature.

Redressings.

In making a change of dressings great care as to asepsis and gentleness in cleaning the eye must be exercised. The nurse is to have in readiness a bowl of warm boracic acid solution (saturated), or bichloride of mercury (1 to 5000) or other solution, according to directions of the sur-

geon. Into this bowl of solution should be placed a number of cotton balls (mops) to be used in sponging the eye. A separate bowl with dry cotton balls should be at hand. In addition to these the necessary dressings, eyepads, gauze, bandages, zinc plaster adhesive strips, shields, safety pins, etc., together with the usual remedies, cocaine, atropine, eserine, silver nitrate solutions, iodoform, etc., all on a tray or in a basket should be on a table convenient to the patient. Some surgeons (Gruening) have a special basket to hold all the necessary dressings and remedies in constant readiness, so that the nurse is ready at a moment's notice to accompany the surgeon on his rounds in the hospital, warm solutions of boracic acid or bichloride being the only things necessary to get ready after the surgeon arrives.

To remove a dressing. A towel should first be placed under the chin of the patient, and if much solution is to be used in softening the dressings, as after a plastic operation, a rubber cloth over this. The mask or shield must first be taken off; then the bandage is cut on the side of the head with a dressing scissors, or it may be carefully unwound, taking care not to drag the dressing off with it. If adhesive strips are holding the dressing they are loosened above, then a stream of the warm solution is squeezed from a cotton sponge on to the dressings and between the upper edge of the dressing and the eyelid, holding the dressing in the meantime with a dressing forceps in the disengaged hand so as to remove it when loosened by the solution. If the inner layer of gauze sticks to the lids, this should be thoroughly soaked with the solution, the upper edge loosened, and a stream of water squeezed from a cotton sponge between it and the lid. When the dressings are off, the edges of the lids are to be sponged with a wet cotton ball to free them of dried secretions, the lower lid pulled gently down, and a

little of the solution squeezed into the eye, if any mucus or discharge is present. The greatest of care is to be exercised in putting any solutions or drops into the eye, after the first two or three dressings following the operation for extraction of cataract, or other operations where the anterior chamber is opened, especially until the wound is healed. The *patient should always be warned* just before a solution or a drop is to be put into the eye; because if put in suddenly and without warning, the patient is liable to jump, or squeeze the lids and to do great harm to the eye. In fact, I have seen an eye lost after extraction of a senile cataract by a drop of atropine being dropped carelessly into the eye on the third day after the operation, without warning to the patient, who squeezed the eyelids violently, opened the wound, expelling some of the vitreous, resulting in violent inflammation and loss of the eye. Worse, in this instance, sympathetic inflammation was excited in the fellow-eye, and that, too, was lost!

The unoperated eye should be cleansed also, when the dressings are off. The dressings are then reapplied, but, before the bandage is put on, the hair should be brushed. All discarded dressings are burned at once.

It is hardly necessary to say that all antiseptic and aseptic precautions must be observed on the part of nurses, attendants, and the surgeon in redressing the eye, especially so until the wound is healed.

SHADES AND PROTECTIVE GLASSES.

After all dressings have been removed from the eyes, following operations, and in inflammatory conditions of the cornea and deeper structures, it is desirable to protect the eyes from the light. This may be done by means of shades or protective glasses.

Drop Shade.—This may be single or double. The single drop shade is semicircular in shape, 3 inches long on the straight edge and from 1½ to 2 inches wide at the center. It is made of brown or other stiff paper and covered with black silk on both sides. Tapes are sewn to each corner with which to tie it over the eyes. The drop shades bought at stores and held on by elastics are not desirable, as they cause too much pressure on the head and brow.

The double drop shade is shaped very much like the Moorfields bandage, shown in Fig. 18, and is of the same size. It is made of the same material as the single shade; at each corner, on one edge only, tapes are sewn with which it is tied to the brow, the lower edge hanging free and shading the eyes. It may have a notch on the lower border for the nose, but this is rarely necessary.

A shade, shaped like the bill or beak of a cap, may be made from stiff pasteboard or cardboard, and holes cut in each end into which tapes can be tied with which the shade is fastened on the head.

In the country an ordinary sun-bonnet is often used by ladies as a shade, and, by the way, makes an efficient one.

Shades when soiled, or when no longer needed for the one case, should be destroyed, as they may convey infection.

Protective Glasses.—These are often worn for the same purposes as shades. They come in several shapes and colors. When the light is to be kept almost completely from the eye, dark goggles with wire gauze at the sides fitting close to the orbit are to be preferred. Ordinarily, however, "coquilles" made in the London smoke glass are the best, the amount of light admitted to the eyes being gauged to some extent by the more or less dark tinting of the glass. No. 1 tint is grayish in color, while No. 7, the darkest tint that is made, is almost black. Tints No. 3 and

No. 5 are the ones most commonly worn. Some surgeons prefer blue-tinted glasses, while some others order green or yellow. In recent years, a tinted glass known as Crookes, in two shades "A" and "B," has been much used, both as a protective glass and the lighter shade "A" ground in corrective glasses.

Protective or shaded glasses should be plain, that is, have no refractive power. Occasionally glasses for visual purposes are ground in tinted glass, the Crookes' glass being the one most used for the purpose—in two shades—"A" and "B."

Old, soft linen is the best material for cleansing glasses. When greasy, as when wet with perspiration, glasses should be washed with soap and water, to which a little ammonia is added. They are then carefully dried with soft linen. A clean linen handkerchief answers the purpose fully.

Artificial Eyes.

Artificial eyes are usually made of glass, and are worn in the empty orbit after enucleation, or over the stump of the eye after evisceration, as after the Mules operation. After enucleation the reform eye of Snellen, which is a hollow shell, should be used, as it gives more fullness to the eye and has not the sunken appearance of the ordinary shell or artificial eye. After the Mules operation, and where there is a considerable stump of the eye remaining, the simple concave shell is preferable. Artificial eyes should be inserted about one week after an enucleation, and in three to six weeks after a Mules operation.

Any discharge from the orbit is a contra-indication to its insertion. Too long delay in inserting an artificial eye after enucleation allows the orbital tissues to contract and

difficulty may be experienced in getting an eye of sufficient size into it. For this reason, the sooner an artificial eye can be inserted with safety, the better.

The surfaces of the artificial eye should be entirely smooth and have no rough edges. It is a good plan to wear the eye for a few hours at a time, for the first few days, and gradually increase the time until it can be worn all day. At night it should be taken out, washed, dried, and laid away out of the dust till morning. The orbit should be washed with salt water or boracic acid solution night and morning, and, should any discharge or irritation of the orbit supervene, a mild astringent should be used. If the discharge is persistent a few applications of a 2 per cent. solution of silver nitrate should be applied to the orbit, and the eye left out for a few days. An artificial eye should be renewed yearly; certainly not longer than two years should elapse without a change, as the surfaces become roughened and cause irritation of the conjunctiva.

To Insert an Artificial Eye.—First, elevate the upper lid with the thumb or finger of one hand. Second, moisten the eye; push the broader end of the eye under the upper lid, gradually turning the broader end toward the temple until the eye is in a horizontal position and is pushed as high under the upper lid as it will go with comfort. Third, while still holding the eye in this position with the right hand let go of the upper lid and pull down the lower lid with the left hand; now push the lower border of the eye into the lower fold, or *cul-de-sac,* with the right hand.

To Take an Artificial Eye Out.—First pull the lower lid down with the finger of the left hand. Second, place the end of a blunt probe (a clean hair-pin will do) under the lower edge of the eye and gently lift it from the

lower fold of the conjunctiva, when the eye drops out. A towel or other soft material should be spread over the lap of the patient to catch the eye.

Patients learn quickly how to insert and remove these artificial eyes. When removing them they usually lean over a bed, pull down the lower lid powerfully, squeeze the lids tightly, and the eye "drops" out, usually requiring no probe at all.

CHAPTER XI.

WHAT TO DO IN EMERGENCIES.

Injuries to the Eyes from Caustics and Burns—Contusions and Penetrating Wounds—Infectious Materials in the Eyes—Atropine Poisoning—Cocaine and Holocaine Poisoning.

In emergencies it goes without saying that when a physician can be had he should be sent for at once. In the meantime the nurse should be doing something, and that something should be the right thing. So great is the urgency in some instances, as in burns from lime, the mineral acids, and carbolic acid, the eye should be looked after immediately, and the physician sent for later. Quick action may mean the saving of eyesight and the escape of marked deformity.

Injuries to the Eyes from Caustics and Burns.

Lime Burn.—Lime in the eye in its pure state or in the form of plaster or mortar is not an uncommon accident. It acts as a violent caustic and corrosive, and if not seen speedily and removed does irreparable injury to the sight and often causes adhesions between the lids and the eyeball (symblepharon).

No water should be used to remove lime from the eye, as water slacks the lime and causes it to burn worse. A clean handkerchief or a little piece of gauze smeared with sweet oil, castor-oil, vaseline, lard, or butter should be used to wipe every particle of lime from the eye. The lids should be forcibly everted, to see if any of the lime is in

the *cul-de-sac* or deep folds of the conjunctiva. A saturated solution of sugar may then be used to wash the eye thoroughly, as cane-sugar forms an insoluble compound when mixed with lime, and thus neutralizes the action of the latter. If sugar is not convenient molasses may be poured into the eye. Vinegar answers the same purpose, and is usually to be had. It neutralizes the action of the lime. Iced cloths should then be applied until a doctor can arrive, the eye being protected in the meantime with vaseline, sweet oil, or castor-oil.

AMMONIA.—In case of an ammonia burn of the eye, vinegar or lemon juice may be used to neutralize the action of the ammonia. Then cold compresses should be applied to the eye.

MINERAL ACIDS, AS NITRIC, SULPHURIC, ETC.—The first thing to do in acid burn of the eyes is to wash the eyes immediately with an alkaline wash of some kind. Such solutions can be made quickly by mixing borax, soda (baking soda), or potassium bicarbonate with water. Milk may be used if these cannot be had, or even plain water, in lieu of nothing else, to dilute the acid as much as possible. The eye and lids should then be covered with vaseline, oils, or grease of some kind, and iced cloths applied until the surgeon can be called.

CARBOLIC ACID.—This drug is in such common use that, by mistake, by careless handling, or at times by criminal intent, it gets into the eyes. Several such cases have come under my care. In one of these cases carbolic acid was dropped into the eye by mistake for cocaine. If these cases are seen to at once no permanent injury results. The eye should be washed with a solution of alcohol (1 part water to 3 parts alcohol); whisky or brandy in the same strength solution may be used if alcohol is not convenient;

and plain water should be used if none of these are on hand. Vaseline or oils are used to protect the eye, and iced cloths applied to keep down the swelling and edema.

Burns.—The eyes and lids are often injured by steam, boiling water, fats, or by molten solder or lead, hot cinders, ashes from cigar or pipe, curling irons, etc. The first thing to do here is to remove any foreign substance from the eye, if still in it, and then to protect the eye and lids with vaseline or oils. Over this may be placed an improvised antiseptic dressing, as a clean linen handkerchief wrung out in a weak solution of carbolic acid (1 per cent.) or boracic acid (saturated). Iced cloths can be applied over this antiseptic dressing. Where the burn is very extensive and accompanied by great pain and shock, stimulants should be administered and also opiates.

Injuries to the Eyes by Contusion or by Penetrating Wounds.

In all cases of injury to the eyes or eyelids from violence, especially where there is an abrasion, contusion, or penetrating wound, the first requisite is to wash the eye and wound with a clean solution of some kind. Boiled water allowed to cool may be had on most occasions. A saturated solution of borax, or boracic acid, or a 1 per cent. solution of carbolic acid, or of 1 to 5000 bichloride of mercury solution may be used if conveniently at hand. If the eyeball itself is injured, in addition to cleansing the eye, a drop of atropine sulphate (1 per cent.) should be instilled if it can be procured. A clean handkerchief wrung out in sterile water or any one of the above solutions may be used as a dressing and held on with a bandage made from strips of a sheet or of an apron, until proper surgical assistance can be had.

Infectious Material in the Eyes, as Pus from Gonorrheal Ophthalmia, or the Membrane from a Diphtheritic Throat.

Occasionally a nurse, attendant, or surgeon may have pus squirted into his own eyes while cleansing the eyes of a patient suffering with gonorrheal ophthalmia. It also happens at times to have part of the membrane from a diphtheritic throat coughed into the eye of the nurse or surgeon. In either instance the very first thing to do is to wash the eye thoroughly with a solution of bichloride of mercury (1 to 5000). Then drop into the eye 2 or 3 drops of a 2 per cent. solution of silver nitrate. If a 25 or 50 per cent. solution of argyrol, or a 5 per cent. solution of protargol is ready, either may be used in place of the silver nitrate. The above treatment is somewhat painful, but efficient. Iced cloths may be applied for a half hour to relieve the irritation.

Atropine Poisoning.

In poisoning from atropine, scopolamine, and other drugs of this nature, the throat is very dry, there is much difficulty in swallowing, and there may be dizziness. The pupils are dilated and fixed; the conjunctiva red and swollen; the face flushed, and, at times, affected with a pseudo-erysipelas; and the pulse rapid. Convulsions may come on; and delirium, ending in coma and death, ensues in some cases. Cardiac stimulants should be given at once, as coffee, whisky, and strychnine; and demulcent drinks to moisten the mouth and throat are indicated. In very severe cases hypodermic injections of morphine as a physiological antidote, and caffeine and camphor, as heart stimu-

lants, are to be given. Where there is marked stupor the application of hot bottles to the extremities and artificial respiration should be resorted to.

Cocaine and Holocaine Poisoning.

The symptoms here are usually weakness; dizziness; very weak, rapid, and irregular pulse; and, at times, delirium. Place the patient in the prone position and loosen the clothes about the neck and waist. Stimulate with whisky and coffee by mouth, and give camphor or strychnine hypodermically.

PART II.—EAR.

CHAPTER I.

ANATOMY AND PHYSIOLOGY OF THE EAR.

Anatomy.

In considering the subject of the anatomy and physiology of the ear it is necessary, for the purpose of this book, that this chapter should be extremely elementary and brief. The duties of the nurse may be performed without a knowledge of the anatomy or physiology of the ear, but her work is rendered more efficacious, her technique more perfect, and the interest of her work is enhanced by an understanding of these points. If there is any wish to know more about the subject than is given here, the nurse should consult one of the standard works upon the ear, where this information may readily be obtained.

The ear is divided into three main chambers, which are *en suite,* just as one room of an apartment follows immediately upon another in a majority of the New York apartments. The first, or external chamber, is the external auditory canal. This has a very pretentious portal in the form of the external ear or auricle, which projects from the side of the head and is known as the ear. The second chamber of the ear is known as the middle ear, and this chamber is furnished with a hanging like a curtain, called the drum, which separates it from the external ear. This middle ear is furnished with three bones called ossicles, and named, respectively, the hammer (malleus), the anvil

(incus), and the stirrup (stapes). The first of these bones, the hammer, is attached to the drum on the middle ear side; the next, the anvil, is attached to the hammer, and is also fastened to the roof of the middle ear chamber; the stirrup is attached by its small end to the anvil, while the footplate of the stirrup rests upon a small window which leads into the third chamber, or the internal ear. This third chamber of the ear is composed of two parts—one known as the cochlea, from its resemblance to the coils of a snail shell; and the other part as the semicircular canals. Both the cochlea and the semicircular canals possess a window which looks into the middle ear and lies on its internal surface, while the cochlea and the semicircular canals themselves are contained within that part of the temporal bone which is known as the petrous portion.

The stirrup fits into the window which leads from the cochlea chamber, but is separated from it by a small membrane, which is sometimes known as the internal eardrum. This opening from the middle ear into the cochlea, to which the stirrup is attached, is known as the foramen ovale. The opening of the semicircular canals into the middle ear is also partitioned from this cavity by another membrane. None of the bones of the ear touch this membrane, as we have found to be the case in the membrane which spans over the foramen ovale. This opening from the semicircular canals into the middle ear is known as the foramen rotundum.

Patients often refer to the fact that there are three drums in each ear. By this they mean that the first drum is the membrana tympani, which is the membrane stretching between the middle and the external ear; that the second drum is the membrane which stretches across the foramen ovale, separating the cochlea from the middle ear

and receiving the footplate of the stirrup upon its middle ear surface; while the third drum is the membrane stretched over the foramen rotundum, and separates the contents of the semicircular canals from the chamber of the middle ear. It is true that these are three drums, but it is better to disregard the term "drum" as applied to the last two membranes and reserve it for the large membrane which separates the external canal from the middle ear—that is, the membrana tympani.

The external ear consists of two parts—the canal and the auricle. The auricle is composed of cartilage containing many convolutions, and is covered with skin containing a small quantity of fat. The auricle is set on the head in such a way that it catches sound waves and transfers them to the canal of the ear. It is arranged so that it receives sounds coming anteriorly and somewhat laterally better than sounds coming from behind. The canal of the ear is continuous with the auricle, is about 1¼ to 1½ inches in length, and oval in shape. The direction of this canal is forward and inward, and it is slightly curved in the middle, so that in order to see the drum at the opposite end of the canal it is necessary to lift the auricle upward and backward. This obliterates the curve in the canal and allows inspection of the drum. The canal of the ear is partly bony and partly membranous and cartilaginous. The bony part is internal. The canal of the ear is covered with skin, which contains near the external auditory canal a number of prominent hairs serving as a protection against insects. It also contains a number of glands which secrete what is known as earwax, the purpose of which is undoubtedly to afford a sticky surface that will prevent the entrance of insects into the deeper parts of the ear or will serve to catch particles of dust or other foreign material that may

be introduced within the canal. When the auricle is pulled upward and backward, if the external canal is open, it is possible to observe the drum (membrana tympani). This stretches across the canal of the ear and separates the middle from the external ear. It is attached at its edge to a small rim of bone which in child life is separate from the temporal bone, but very soon becomes ossified and attaches itself to the surrounding parts as a part of the temporal bone. The drum of the ear is composed of fibrous tissue membrane, and on the side of the external canal is covered with a thin layer of epithelium derived from the external canal, while on the opposite, or internal, side it is covered with a layer of mucous membrane derived from the middle ear. The position of the drum within the ear is not perpendicular, but it is inclined from above downward, slightly inward and forward, so that it occupies an oblique plane. About the center of the drum, in many cases, may be observed, shining through it as a long white process, the long arm of the hammer.

Internal to the drum is the cavity of the middle ear. This cavity in an average skull is a rectangular chamber measuring about ½ inch in height, ⅝ inch in length, and ½ inch in breadth. The roof of the middle ear is known as the attic and is separated from the brain by a thin and delicate plate of bone, scarcely more than $\frac{1}{24}$ inch in thickness. In the back wall of the middle ear, at its upper part, is a large opening known as the mastoid antrum. This is a communication which exists between the middle ear and the mastoid cells, which lie posterior to the middle ear and within the mastoid portion of the temporal bone. This is one of the important landmarks to the operating surgeon in mastoid operations. On the wall of the middle ear nearest the median line of the body—that is, its internal wall—

one observes a marked prominence, which is the wall of a foramen conducting the facial nerve. This nerve is distributed to all the muscles of the face, and if it is injured in the mastoid operation a facial paralysis results. In front of this canal for the facial nerve is the oval window; on the floor of the middle ear at its anterior end is a large opening. This is the ear orifice of the Eustachian tube, the other end of which opens into the naso-pharynx. Beneath the floor of the middle ear and separated from it by a thin shell of bone is the internal carotid artery. The middle ear is not an empty space. It is lined, as a room is papered, with a mucous membrane, continuous with the mucous membrane of the naso-pharynx through the Eustachian tube. It also contains the three bones of the ear, or ossicles, and certain ligaments and muscles which hold them in position. The ossicle called the hammer is, as we have already mentioned, attached by its long process to the drum of the ear, while its head rests upon that part of bone described as the attic. It is kept in position by the ligaments and is capable of slight motion by the action of the tensor tympani muscles upon the head of the hammer.

The anvil is the second bone of the ear and lies between the hammer and the stapes. Its base is attached to the head of the hammer. To the long process of the anvil is attached the stapes. The footpiece of the stapes fits into the oval window, and is attached to a membrane stretched across this opening.

The remainder of the ear is known as the internal ear. It lies within the petrous portion of the temporal bone, and is divided into two parts—the cochlea and the semicircular canals.

The cochlea is a spiral canal with two and a half turns. The canal is wider at the mouth than at the top. The wide

part of the cochlea is the foramen ovale, to which it will be remembered the stapes is attached. The cochlear space is filled with a liquid known as the perilymph, and on the sides of the canal are to be found the terminal filaments of the auditory nerve, distributed particularly at the outer surface of each canal, and known as the organ of Corti. The finer anatomy of this terminal auditory nerve scarcely concerns us in this superficial description, but it is sufficient to say that the nerve terminates in a number of sensitive cells which are bathed in the perilymph. The semicircular canals are known as the posterior, vertical, and horizontal. They are arranged in such a way that the three canals make five openings into the main ampulla, the base of which is the foramen rotundum, previously described. The auditory nerve is also distributed within the semicircular canal, but here it fulfills a different function from that in the cochlea. The auditory nerve enters this region through the auditory foramen. It is found within the middle fossa of the brain, and within the brain is distributed to the part known as the hearing center.

Physiology.

The external ear collects the sound waves and conducts them to the tympanum. It is possible also that the external hearing organ intensifies the sound. The auricle is cone-shaped, and is directed forward and outward in such a way that it will receive any sound wave which reaches the individual. As soon as the sound waves are received upon the surface of the auricle they are deflected by the internal curve of the auricle toward the external canal of the ear, and as they approach the internal part they are, so to speak, packed together or condensed. In this way it is probable that the auricle not only collects the sound waves,

but brings them into a smaller space, so that more waves may be conducted through the smaller external canal of the ear. It will be noticed that the entire auricle inclines toward the external canal, and as soon as the sound waves have been deflected and condensed they impinge upon the walls of the external canal and are conducted through it to the drum of the ear. As soon as the sound waves reach the drum of the ear, this elastic membrane is made to vibrate by the impact of the sound wave against it. The drum membrane is forced forward, slightly inward, and in the intervals between the waves it recovers its former position. Thus a very rapid vibration of the drum is excited, which sets the entire contents of the ear in action. The ossicles of the ear are then brought into play, being drawn to and fro with each movement of the drum. The motion thus imparted to the hammer is successively received by the incus and stapes, and finally reaches the foramen ovale. The membrane of the foramen ovale is now set in motion. Its motion corresponds in intensity and frequency to the vibrations of the membrana tympani. The cochlear side of the membrane stretched across the foramen ovale lies in contact with the perilymph, which now also vibrates with each movement of this membrane. Thus the fluid within the cochlea is set in motion, and the fluid waves excite the terminal cells of the organ of Corti. This, in turn, excites the irritability of the auditory nerve, and the sensations thus excited in the nerve are appreciated at the brain center of hearing.

It will therefore be seen that the sound waves cease to exist as vibrations as soon as they have touched the drum. They are there transformed into mechanical movement, which is made possible by the tiny joints by which the ossicles are attached one to another. The method of trans-

mission changes again at the foramen ovale, where the impulse, which at first consisted of sound waves, then became mechanical movement, now acts upon a fluid, the equilibrium of which is disturbed, forming waves. This force is again changed to mechanical movement by contact with the end-cells of the organ of Corti, and again the character of the sensation changes as soon as the nerve is excited, but the nature of this change has not yet been demonstrated.

The balancing power of the body resides in the semicircular canals. It has been found that if the semicircular canals are disturbed experimentally in animals, or if they are destroyed by diseases in man, the equilibrium is disturbed. An animal whose semicircular canals are destroyed will not attempt to assume its customary position of rest. For instance, an animal which ordinarily rests upon the abdomen will remain upon its back if the semicircular canals have been destroyed; a horse, whose normal position is on its four feet, will lie upon the side or the back, and remain in this position indefinitely, if the function of these canals is abolished. A fish whose semicircular canals and other organs of equilibrium have been destroyed will swim quietly all day in any position in which he is placed—on either side or on his back; and a man whose semicircular canals have been destroyed by disease, loses the power of remaining upright, and is unable to rise from a recumbent position without falling.

The function of the Eustachian tube is to ventilate the middle ear and to permit of an equal pressure of air on both sides of the drum. If, at a certain moment when the atmospheric pressure on each side of the drum is the same, the Eustachian tube should become closed to the admission of air by means of a swelling of the walls of the tube, the

temperature of the air in the middle ear will at once rise and the air will expand. This expansion of air will result either in pushing the drum outward toward the external canal and holding it in this abnormal position, or the rarefied air will escape through the Eustachian tube, leaving a partial vacuum within the middle ear. The partial vacuum will result in a disturbance of the equal pressure on each side of the drum, with the result that the drum will sink in because the atmospheric pressure will be greater than the pressure within the middle ear. Unless this is relieved by a ventilation of the tube, so that the equal air-pressure is re-established, the drum will finally occupy an incorrect position, and the middle ear will become congested and inflamed from the constant suction to which its blood-vessels are subjected by the partial vacuum within the ear. It will be seen that the establishment of an exchange of air from the pharynx to the middle ear is one of considerable importance. This is the only function of the Eustachian tube. When the tube is chronically blocked so that the air is either retained in an expanded state or as a partial vacuum, the pathological changes characteristic of partial deafness are slowly established.

CHAPTER II.

GENERAL METHODS OF NURSING IN EAR CASES.

The Ear Douche—Ear Drops—Painting the External Ear—Ice Coil—Poultices—Heat—Medicinal Applications—Leeches—Method of Politzerization.

THE EAR DOUCHE.

IRRIGATION of the external ear is useful to facilitate the removal of material within the external canal of the ear, or as a method of applying heat to the ear for any purpose whenever it is indicated. It is further useful as a method of applying medicaments to the canal of the ear, and is used by the aurist for all three of these purposes.

The douche should be administered either by means of a douche bag holding two quarts or by means of a large metal or glass syringe, known as the ear syringe. The douche bag previous to being used should be sterilized by dry heat, if possible, but when this is not practicable it serves every purpose if some sterile water, or some 1 to 10,000 solution of bichloride of mercury is run through the douche bag after the outside of it has been thoroughly scrubbed. A word of caution must be sounded against the indiscriminate use of old douche bags which may lie around the house and which have been used for many other purposes for a long time. These douche bags contain at the end of the rubber tube all kinds of bacteria, which, if they do not come in contact with the ear itself, often contaminate the surgeon's hands, and from him are conveyed to the patient's ear. Therefore, if an old douche bag be used, it should not only be thoroughly cleaned, but should be sup-

plied with a new tube. The hard-rubber tip at the end of the tube which is to be used in the ear should be soaked in 1 to 80 carbolic acid solution, or in alcohol, or else should be boiled before it is used on the bag. After the douche has been given, the bag must be dried and wiped, and after the tube has been cleaned the whole douche bag should be wrapped in a clean towel and laid aside until its next using.

Ordinarily, the bag is hung on a projecting nail or held by an assistant at a height of about six feet from the floor. If the patient is sitting in bed or in a chair this will give a fall of water of from three to four feet, which is sufficient pressure for the purposes of douching the ear. If too much pressure is used the douche is apt to cause pain by impinging forcibly upon the drum or the inflamed tissue. When the syringe is substituted for the douche bag the solutions are mixed as for the douche, but are sucked into a syringe from which they are injected with not too much force, the end of the syringe resting within the external canal of the ear. The syringe should also be kept as clean as possible if it is to be used for douching the ear, and it is a good plan to immerse the syringe, or the tip of the douche, in 95 per cent. alcohol when these small pieces are not in use.

The solution for use in the douche bag may be of plain water or, more often, may contain a certain quantity of sodium chloride (salt), which is added to the water in such strength as to make the resulting solution about the specific gravity of the blood (ʒss to ℥xvi). This solution is absolutely non-irritating, and so can ordinarily be used for syringing the ear. The nurse, however, may be called upon to make solutions of other chemicals for use in the douche bag or the syringe. Some of those most frequently used are lysol, in a strength of ½ drachm to the quart; boracic

acid, *q.s.* to saturated solution; alum, 1 per cent.; glycerine, 4 per cent.; glycerine and soda (1 drachm of each to the quart); alcohol, 10 per cent.; peroxide of hydrogen, 10 per cent.

These medicaments are put in hot water, and when they are thoroughly dissolved the water is allowed to cool down to a temperature of about 110 degrees. At this temperature it is poured into the douche bag or sucked into the syringe, and when used represents a temperature of about 106 degrees, which is the proper temperature for irrigating the ear, unless in a few very susceptible patients it produces too much burning, when the temperature may be reduced. In other patients it is possible to use a higher temperature than 106, for, while some patients bear heat poorly, others can stand a very high temperature. During the giving of the douche the temperature of the contents of the bag is apt to lower a few degrees—three or four; so that it is necessary to add some hot solution to that already in the bag, in order to keep the temperature about 106 degrees.

The patient is prepared for the douche as follows: The neck is bared to the clavicle and a piece of rubber sheeting is placed around the shoulder on the side to be treated, and tucked within the collar band. A pus basin or other properly shaped receptacle is placed under the lobe of the ear and firmly pressed to the side of the cheek. If this is carefully done and the vessel retained in this position, not a drop of water will escape below the basin. The patient himself generally holds the basin, and I have noticed that they have a fatal tendency to incline the basin either forward or backward, generally to a considerable degree, so that as the basin fills the water is apt to run over and soil the clothing of the patient.

Everything being in readiness for the douche, the

nozzle is placed in the patient's ear and the flow of water turned on. At first the external ear only is irrigated, but after a moment, during which time the patient becomes tolerant to the temperature of the water, the nozzle is introduced within the opening of the external ear and the water flows through the canal, generally as far as the drum, or to the first obstructing point, when it returns and drops from the lobe of the ear into the basin.

The force of the douche depends greatly upon the condition of the patient. When it is desired to remove impacted cerumen (wax in the ear) it is necessary to use considerable force, and in this case there is no danger of injuring the drum of the ear, because the impacted cerumen acts as a pad between the drum and the flow of the water. As the cerumen becomes loosened and comes away from the ear, it is necessary to use less force than before. In cases where the canal of the ear is much swollen from inflammation, it is useless to use much force in irrigation, and an attempt should be made to fit the nozzle rather accurately, so that the water will enter the ear as far as possible. The quantity of water ordinarily used for a douche is from 1 to 3 quarts; but, unless it is specified by the physician, the nurse is to understand that if an ear douche is ordered 2 quarts at a temperature of 106° are expected to fulfill the requirements.

The douche is generally ordered to be given two or three times each day, but it is sometimes used as often as every two or three hours. After the douche has been completed the head of the patient should be lowered and shaken so that the water will run from the ear, and a bit of dried cotton should be placed in the external canal of the ear, unless something else is ordered to follow the douche.

Unfavorable symptoms as the result of using the

douche are rarely observed. Sometimes patients do not stand high temperatures well, and it is necessary to lower the temperature of the douche to a point which is agreeable to the patient. In a few cases the effect of such a quantity of water produces maceration of the epithelium of the drum and a swelling of the canal, or symptoms of dermatitis are excited by the heat. The maceration of the epithelium may be partly prevented by using a douche of proper specific gravity—that is, by the addition of salt or soda to the water, in the proportion of 1 drachm to the quart. If a dermatitis is excited, it is necessary to coat the lining of the ear with a thin layer of vaseline before using the douche. In a few other cases patients complain of great pain after douching the ear, and a still smaller percentage have attacks of dizziness. Under such circumstances it may be necessary to stop the douche.

WHAT IS ACCOMPLISHED BY THE DOUCHE.

Discharges containing infective material are removed from the ear, and an opportunity is given any pus which may be behind the drum to push its way outward. The beneficial effects of the heat are also obtained from the douche, providing the temperature is high enough. This acts in many cases to prevent the further involvement of the deeper structures of the ear, and it is unquestionably true that even a few cases of mastoid involvement will recover without operation if the douche is used often enough and at a proper temperature.

Ear Drops.

A favorite method of using medicaments within the ear is by means of a medicine dropper. Various drugs dissolved in water, glycerine, or alcohol are used in this way.

Generally, ear drops should be used warm. The drops may either be warmed before being sucked into the dropper or after the dropper is filled it may be held for a few seconds over a gas flame, when the liquid contents will become warm enough for use. The temperature of the drops should always be tested by letting one or two fall upon the hand before they are used within the ear. As soon as the drops have cooled to the proper temperature, which is about 106°, —or, for practical purposes, when they are as warm as can be conveniently borne upon the skin of the hand,—they should be instilled at once into the ear.

The head should be bent upon the opposite shoulder so that the ear to be filled lies uppermost. The auricle (external ear) should be pulled slightly backward and upward, while at the same time it is raised from the side of the head, for this opens and deepens the canal. The entire canal of the ear is now filled with the drops and a piece of cotton is inserted in the exit of the canal, to retain the drops within the ear. If necessary, the other side may now be treated by reversing the position of the head and the ear filled in the same way.

Generally the ear drops are not used until after the douche has been given. In this case it is necessary to empty the ear of the water contents resulting from the douche. This is done by turning the douched ear down and shaking the head. Sometimes the ear drops are used before the douche, particularly when the medicament is intended to destroy pus or to loosen the discharge. Peroxide of hydrogen is almost always used before the douche is given.

Drugs that the nurse will be called upon to use as ear drops are, ordinarily, lysol, in the strength of $\frac{1}{10}$ of 1 per cent.; boracic acid, dissolved in either alcohol or water; a saturated solution of boracic acid dissolved in alcohol or

water or both; cocaine and resorcin are favorite remedies to use in acute inflammations of the ear without suppuration, the vehicle for the solution being water. Cocaine is ordinarily used in a 4 per cent. solution, and resorcin in a 5 per cent. solution. Glycerine—either in the form of plain, chemically pure glycerine or as boroglyceride—is frequently used in inflammation of the external canal, and sometimes in a watery solution is used for ear drops. A solution of:—

Sodium bicarbonate	20 grains;
Glycerine	2 drachms;
Water	1 ounce;

is a favorite solution in the Vienna Ear Clinic for the purpose of removing pus and *débris* from the ear and to prepare the ear for subsequent treatment. Alcohol, 95 per cent., is often used in cases of suppurative ear disease, and peroxide of hydrogen is a favorite treatment with many otologists. It may be used either in the full strength of the solution of the peroxide or it may be mixed with various portions of water, either 1 to 5 or 1 to 10, or 1 to 20. For very stubborn cases of discharge, solutions of nitrate of silver—10 or 15 grains to the ounce—and solutions of chromic acid—5 grains to the ounce—are used within the ear; but both these remedies stain the skin, and great care must be used to prevent them from dropping over the lobule of the ear on the skin of the neck. Occasionally medicaments dissolved in oil are used for the relief of pain or for ear discharges, but the best otologists look with disfavor upon this form of treatment, although it continues to be a favorite treatment with the laity. With otologists, the use of oil within the ear is confined to cases requiring lubrication, particularly where there is eczema of the canal.

External Applications.

The nurse is frequently ordered to make an application to the region behind the external ear, especially the mastoid process. The effect of this application is expected to be alterative or resolvent upon disease within the ear, or it may be used for the relief of symptoms, such as pain and swelling. Ordinarily, a strong solution of menthol and chloral, or a solution of iodine in alcohol (tincture of iodine), or an application of a solution of croton oil is the remedy to be used. Sometimes mustard plasters are ordered. Their application is a simple matter, and consists in rubbing the medicament over the region posterior to the ear for an area of two or three inches. A piece of absorbent cotton soaked in the medicament to be applied forms a ready means of making the application.

The ice coil is an application that is frequently ordered. Sometimes, instead of the ice coil, bladders or bags of rubber are filled with pieces of cracked ice and laid over the region of the ear. The present rule for the use of the ice coil is that it should never be used for more than twenty-four hours. If in that time it does not succeed in controlling the conditions for which it was ordered, no further benefit can be received from it. The application of the ice-bags or ice bladder is a simple matter. Care should be taken that the pieces of ice are not too large or sharp, so that if necessary the patient may lie upon the icebag, since in this position the drainage is better than if the patient lies on the well side and the ice is placed upon the head. When the ice coil is used, it should be one of block tin, either round or else shaped to fit the ear. A long rubber tube is attached to each end of the coil—one tube to conduct the cold water from the tank and the other to carry

it from the coil into a receptacle placed upon the floor. The tank containing the supply of water should be placed three feet above the bed of the patient and should be filled with rock salt, water and ice. The end of the tube is placed within the tank and the flow of water is started by drawing the water with the mouth or a syringe through the tube. From time to time the outlet tube should be raised to see that the flow of water continues. With care the ice coil may be made to work continuously.

POULTICES.

A favorite treatment with some otologists is the application of poultices of one sort or another, for the purpose of giving to the ear a certain quantity of heat and moisture. There seems to be considerable doubt as to how poultices act as therapeutic agents, but it has been definitely proved through ages of experience that the poultice is one of the most valuable remedies that we have in the treatment of inflammatory conditions. It is claimed by some that poultices act to resolve and scatter inflammation, but most physicians believe that poultices act to limit the areas of inflammation, to increase the exudation of leucocytes, and in this way to increase the quantity of material which is drawn to a suppurating point for the purpose of destroying the bacteria causing inflammation. Besides this indirect power of destroying the bacteria through leucocytes by attracting them to the seat of inflammation, the heat of the poultice is useful for the relief of pain and is grateful to the patient from the support which it gives.

A well-made poultice should be soft and hot, and should contain enough water so that it is very flexible. It should not be made so soft that the liquid contents could escape through the covering into the surrounding regions.

The poultice should be renewed as soon as its temperature lowers. Ordinarily every hour or every two hours is often enough to apply a new poultice, but under some circumstances the poultice may be left as long as four hours, particularly if it is covered with rubber tissue and a bandage.

A poultice may be made of a properly shaped piece of flannel which has been dipped in hot water, and over which a hot-water bag may be applied. This is a convenient and ready form of poultice.

Ordinarily, poultices are made up of a mass of water with starchy and oily material, such as flaxseed, slippery elm, or hops. Enough hot water should be used to make a soft and slippery mass. The water should be hot enough so that when the poultice is spread it will be necessary for the temperature to drop a few degrees before the skin will tolerate the heat. When the mass has been prepared, it should be spread between two layers of cheese cloth or thin linen—the edge of the cloth folding over the edge of the poultice so as to cover a part of its back and prevent the mass from oozing out between the layers. Sometimes poultices are put into bags made of similar material. The poultice should be covered with rubber tissue and retained in place by a properly adjusted bandage. It is a good practice to lay a hot-water bag upon the poultice, for this keeps it warm for a long time.

Great care should be taken that the poultice does not burn the skin. If they are applied too often or too hot, the skin becomes macerated and blisters, and in this condition it is very sensitive. In such cases the poultice can be discontinued, a vaseline dressing applied, and time enough should elapse for the sensitiveness of the skin to lessen.

A very satisfactory ear poultice may be made from a piece of absorbent cotton heated in plain water. This is

applied to the mastoid and auricular region, and over this a piece of rubber tissue is placed, and the whole mass confined beneath a thick layer of absorbent cotton and a gauze bandage. A very clean poultice which may be kept for a long time at a constant temperature may be made by putting a thick piece of cotton wet with hot water next to the skin, over this is placed a bit of rubber tissue and over the whole an electric heated pad (electric poultice). The heat from such a combination is steady and continuous. The renewals are necessary only when the cotton pad becomes dry. Instead of plain water the pad of cotton may be soaked in alcohol, menthol and alcohol, turpentine and water, alum solution or lead and opium lotion.

Sometimes the external canal of the ear requires poulticing, and in such cases a very small cylindrical bag may be constructed, containing flaxseed, which may be placed within the canal; or a convenient canal poultice may be made from the center of a roasted onion. An onion freshly roasted contains a great deal of moisture, which reaches a high degree of heat. If this is freshly split open a cone-shaped center is obtained which slips into the external canal quite readily. Such a poultice is certainly a very sterile one, since it is impossible for germs to reside within the layers of the onion.

When poultices are ordered for ears which are discharging, they must be inclosed with sufficient care so that when the patient lies upon the poultice it will not press out upon the bed. This is very important, since a discharging ear drains better if the patient lies upon the side which is discharging, and a poultice subject to continual pressure from the head is very liable to break through its delicate covering of gauze and distribute itself over the patient's neck, or decorate his bedlinen.

If the skin shows any particular susceptibility to the application of the poultices—that is, if it becomes reddened, and more especially if it becomes tender to the slightest touch of the fingers, it should be protected from the direct application of the poultice by means of a rather generous layer of vaseline or ointment of the oxide of zinc. Instead of poultices, sometimes a substitute is employed in the shape of hot-water medicinal applications. These are medicaments dissolved in hot water and applied by means of a flannel which takes up a considerable quantity of the medicine with the hot water. These are applied after the excess of water has been wrung out, in the same manner as a hot flannel poultice is applied next to the skin. This is covered with rubber tissue and kept in place by a properly applied bandage. Commonly such hot medicinal applications are composed of weak solutions of turpentine, solutions of menthol, a solution of alum, the ordinary lead and opium mixture, or an ichthyol solution.

LEECHES.

The application of a leech to the mastoid region, or sometimes to the region over the parotid gland in front of the ear, is advised by many otologists and practised quite frequently. Care should be taken to choose leeches which have not been fed for some time. The leeches should be taken from the water in which they are swimming and emptied into a dry box, and from thence received in the end of a leech tube.

This leech tube is constructed of glass and can be obtained at almost any drugstore. The large end of the tube receives the head of the leech—that is, the end of the leech which rises in the air and marks the direction of advancement. The small end of the tube must be closed with the

finger, but between the finger and the tube a small piece of paper should be placed, to prevent the leech from fastening to the finger of the nurse. The leech will not turn in the tube, so that the bare finger may be placed at the other end.

The tube is transferred to the region to which it is desired that the leech shall adhere, the bit of paper on the end of the tube removed, and the end of the tube applied directly to the skin. If the leech is to be an active therapeutic agent he will, after a moment, fasten his head to the skin, insert his lancet, and begin to pump blood. During this period the tube should be retained in place, but after it has been found that the leech has fastened, the tube may be very carefully withdrawn, so as not to disturb the attachment of the leech. The posterior end of the leech will not remain attached to the tube, and when the tube is completely withdrawn it will gently fasten itself to the skin. Occasionally a leech will not fasten upon the skin, and this is generally due to the fact that the surface of the skin contains some salt. If a leech is reluctant to fasten, the part should be washed with plain water. Sometimes if they are reluctant to fasten after the skin has been washed, they may be coaxed to work by a weak solution of sugar and water placed on the skin. If after repeated trials the leech will not adhere, it should be thrown aside as worthless and a new one substituted.

It must not be forgotten that whenever these animals are to be used the external canal of the ear must be plugged with cotton, for leeches which refuse to fasten sometimes wander quickly over the region of the head and have been known to make their way within the auditory canal, in which region they have been known to fasten, producing much fear, pain, and dread on the part of the patient.

Three leeches are ordinarily applied, but as many as

six may be used. Generally two are placed in front of the ear over the parotid region, and four behind over the mastoid. As the leeches fill with blood, their sucking movement grows less active and afterward very slow. At this moment they are ready to release themselves and as they do so they roll quickly over the neck and upon the shoulder or bed of the patient. They should be at once returned to a dry vessel, from which they should then be transferred to water, when after a period of fasting they will again be ready for work.

The leech bite should be allowed to bleed. It should be treated with an antiseptic powder and dressing, the same as any slight wound.

Erysipelas sometimes arises in the site of the bite after leeching, and in such cases it is supposed that the erysipelas germs have been transferred to the patient from the surface of the leech. Against this there is no preventive, but fortunately the accident occurs very rarely.

Preparation for Politzerization.

This method is one of introducing air under pressure from the nose into the middle ear. It may be performed with a rubber bag and soft rubber tube with an olive pointed end, which fits into the nose; or the bag may fit directly into the Eustachian catheter which has been introduced through the nose into the Eustachian tube.

The nurse should prepare for this special treatment a Politzer bag, a Eustachian catheter, a few applicators wound with cotton (to remove the discharge from the ear), and an ear speculum. If the nurse is ordered to give this treatment herself, it will generally be suggested to her how it should be carried out; but it may be well, in case such instructions are omitted, to say that the nurse should never

use the Politzer bag with the Eustachian catheter, but only the bag to which is attached a soft rubber tube having a large olive pointed nosepiece. The nosepiece is introduced into the nose upon the side requiring inflation, and the patient's mouth is closed, while at the same time the opposite side of the nose, as well as the side containing the end of the Politzer bag, is kept tightly closed by finger pressure. At the moment when the patient fully puffs the cheeks, the bag should be quickly and firmly pressed, and the air will be blown into the middle ear. The operation of puffing presses the soft palate against the posterior pharyngeal wall and prevents the escape of air into the pharynx; but in some cases the palate does not rise against the wall and shut the nose off from the throat. It is then necessary to have the patient hold a small quantity of water within the mouth, and at the bidding of the nurse the water should be swallowed; at the moment when the larynx rises to its highest point during the act of swallowing, the water will have reached the pharynx and the soft palate will automatically lift against the posterior pharyngeal wall in this way shutting the nose off from the throat; when this moment has arrived, the bag should be firmly and tightly squeezed, and its air contents forced through the tube into the middle ear.

CHAPTER III.

PREPARATION FOR OPERATION.

Sterilization for Operation—Sterilization of Nurse—Sterilization of Surgeon—General Directions for the Operation—Arrangement of the Aurist's Table—Arrangement of Instruments—Preparation of a Living Room for Operation.

STERILIZATION FOR OPERATION IN EAR CASES.

WHEN it is necessary to prepare the region of the ear for operation, unless a special method is indicated by the attending surgeon, the nurse should proceed as follows: The hair in the immediate vicinity of the ear should be clipped with a pair of scissors for a space of two inches behind and above the ear. After the hair has been clipped the scalp in this region should be shaved. Under some circumstances it may not be necessary to cut away any of the hair; and if it is decided that no hair need be removed the nurse should scrub the scalp and hair the day preceding the operation with tincture of green soap, which after being well rubbed into the scalp by friction of the fingers should be removed with plain hot water. The hair should then be dried and a second application of the tincture of green soap applied to the region of the hair and for two inches above and behind the ear. This should be left on the night preceding the operation and in the morning of the day of operation the area should be scrubbed again with green soap and water, during which time especial attention should be devoted to the folds of the ear. An applicator wet with soap and water may be applied within the canal of the ear, and this region partially cleansed. A piece of cotton should

then be placed within the canal and the ear thoroughly dried. It should then be scrubbed with bichloride solution, 1 to 1000, and after drying again sulphuric ether should be poured on the cleansed part. It is now ready for operation.

If the operation is not to be performed at once, a pad of wet bichloride solution, 1 to 5000, should be placed over the area and secured in position with a gauze bandage. When the patient is ready for the table, the bandage and pad may be removed, and an ordinary rubber bathing cap, such as ladies use, should be adjusted over the head, so that the hair may be kept from the wound and protected from soiling with blood. Tincture of iodine 3½ per cent. solution, painted over the parts to be operated upon and the adjacent regions, even upon the hairy parts, is a most efficient way to sterilize the skin. After two minutes it should be removed from the skin by washing the parts in alcohol applied on sterile cotton. The field is now ready for operation.

The patient should now be put upon the table, when the region may be sterilized again if it is thought advisable, by scrubbing with bichloride and the use of ether afterward, as has been previously described. If, however, the sterilization has been carefully done, the case will not need another sterilization.

The patient should lie upon the side which is not to be operated upon, and all but the region of operation should be covered with sterile towels secured in position with sterile safety pins. Of course, before the patient is placed upon the table the general preparation is supposed to have been carried out—that is, no solid meals should be given for twelve hours before the operation, and for eight hours preceding the operation nothing but a cup of plain broth should be given. The stomach should be absolutely empty for four

hours preceding the operation, and the patient should not be allowed to have even a sip of water during this period. If the bowels have not been freely moved by the purgative which should have been administered twelve hours before the operation, they may be moved immediately before going to the operating table by means of an enema.

To Arrange a Table for the Treatment of Ear Diseases.

It is frequently necessary for the nurse to improvise a place for the otologist to treat a case of ear disease at the home of the patient, and it is a great convenience and economy of time if she understands how a table should be arranged for the treatment of ear disease.

The first requisite is a fairly steady table, which should be covered with a clean tablecloth or with towels. Two chairs should be placed on one side of the table, in such a way that the right side of the patient and the left side of the physician will touch the table. Upon the table opposite the seat in which the patient is to sit, a light, either Argand or electric, should be placed, so that the height of the flame will be on a level with the ear of the patient. It is always better that the light should reach the headmirror of the physician on his left side, because then the right hand does not come within the line of the light. Upon the table should be placed two or three shallow dishes or deep soup plates, or a finger bowl. These should not be put on the table until they have been cleaned with boiling water and wiped dry. The douche bag should be filled with the proper irrigating solution when it is necessary to give a douche and should be ready for use. The nozzle of the douche bag should lie in an antiseptic solution upon the table.

It is necessary to have a certain quantity of absorbent cotton, a few sterile gauze pads, a tube of iodoform gauze, and a few bandages, ear specula and mirrors, as well as a few applicators on which cotton may be wrapped. Other instruments which may be brought by the surgeon may be arranged upon that part of the table nearest his chair. A few medicines which may have been forgotten by the aurist are always appreciated if present. The more useful of these are a 6 per cent. solution of cocaine, a solution of peroxide of hydrogen, a tube of sterile vaseline, and a quantity of powdered boracic acid.

One of the dishes should hold a solution of lysol, ½ drachm to the pint, for the reception of the instruments as they are used.

Arrangement of an Instrument Table at the Time of Operation.

When operations are to be performed in the hospital, the arrangement of the table to hold the instruments is a mere matter of routine, and the instruments are placed upon the table ordinarily by one of the physicians who is familiar with their position; but in an operation in a private house it may be a part of the nurse's duty—besides arranging the room properly for the operation—to lay the instruments out on a table in a way that will meet the approbation and convenience of the operating surgeon.

The instruments to be used in the operation should be taken from the receptacle in which they are brought to the house, and if they have not already been sterilized they should be divided into classes; knives and needles, and other cutting instruments except scissors, should be placed in alcohol, 95 per cent., after they are wiped on a damp, ster-

ile towel. Here they should remain until the other instruments have been sterilized and removed to the table. Then they may be taken from the alcohol and placed upon the table. The sharp instruments should be placed upon the table at the upper right hand. The remainder of the instruments are transferred from the sterilizer, where they should have been boiled for fifteen minutes to half an hour, and placed in cold, sterile water. In this way they cool quickly and are more readily handled. They are then carried in this cold water to the operating room and arranged in somewhat like the following manner: The chisels should be laid upon the table near the knives. The handles of all the knives and chisels should point toward the operating surgeon, as in this position they are more easily grasped and there is less danger of wounding the fingers. The mallets should be placed next to the chisels. All bone-cutting instruments and retractors should be placed below the knives, their handles pointing toward the operator. Needles, sutures, and ligatures should be placed in dry trays at the left upper corner of the table. Curettes should be arranged at the lower left hand corner of the table. The dressings to be used in the case should not be placed upon the instrument table, but should occupy a smaller adjoining table.

Preparation of a Living Room for Operation.

It is often necessary for a nurse to transform an ordinary living room of a private house into an operating room, and this frequently has to be done on very short notice. It is, however, not a difficult matter to arrange such a room in a fairly satisfactory way.

The first requisite is good light, and, if the operation is to be prolonged after a time past 4 o'clock in the afternoon, the ordinary daylight, especially in winter, should not be

depended upon. In fact, some arrangement for artificial illumination should always be made—preferably by means of an electric bulb; but, if this is not forthcoming, then an ordinary Argand oil lamp is the best form of illumination. Daylight, of course, is the best of all, but is not of great service if it is necessary for the aurist to work within the external auditory canal. In such a case, some artificial illumination is always needed.

As soon as the nurse receives orders to prepare a room for operation, she should proceed in the following way: Two-thirds of the entire floor should be covered with sheets, including, first, that part of the floor where the operating table is to stand. These sheets should come fresh from the linen closet, and should not be unfolded until they have reached the operating room. They may be pinned or tacked over the carpet.

For ear operations it is not necessary or advisable to do all the preliminary work for the preparation of a living room which is carried out in laparotomy cases. It is not necessary that the walls should be scrubbed or the carpet removed. After the sheets have been spread in position, an ordinary kitchen table should be carried to the room. This table should receive a thorough scrubbing with soap and water, or one of the sand soaps commonly found in kitchens, after which it may be dried. It should then be washed with a solution of bichloride of mercury, 1 to 1000, after which it may be carried to the operating room and placed in position where a side light can be secured.

The nurse should now secure from the linen closet a number of clean sheets, 12 or 15 towels, and a pillow slip; and from the drugstore a pound of absorbent cotton and a quantity of absorbent gauze, which should be cut into strips and folded into pads. These pads should be in two sizes—

3 by 4 inches, and 5 by 6 inches. A few pieces of narrow gauze packing should also be prepared. All the material from the linen room and drugstore should be wrapped in a clean sheet, when it may be sterilized in one of two ways: either by dry heat in the kitchen oven or by steam in an ordinary kitchen boiler.

If it is to be sterilized in the oven, it should be wrapped in two or three layers of old cloth, to prevent burning, and placed in the oven for half an hour. It will then be thoroughly sterilized, and the coverings will be more or less scorched. After the coverings are removed, the dressings will be found sterile and unscorched.

If the dressings are to be sterilized in a boiler, the latter should be placed upon the stove with hot water covering its bottom to the depth of an inch. The packages of dressings are now laid within a sheet and this sheet is placed within the boiler in such a way that it is suspended above the water, the edges of the sheet lying over the rim of the boiler. The cover of the boiler is then adjusted so as to hold the sheet securely in place and the edges of the sheet folded over the top of the boiler cover and tied firmly. This holds the dressings suspended from the boiler top well over the water, and they are sterilized by the steam without becoming too wet. After thirty or sixty minutes of boiling, the steam will have penetrated every part of the packages and the dressings will be thoroughly sterile. They may now be taken from the boiler and carried to the place which is to serve as an operating room.

The basins to be used in the room should be washed in soap and water and scalded with boiling water, both inside and out, and should then be allowed to become dry without wiping.

In the improvised operating room the instruments

should be arranged opposite the side of the table where the surgeon will stand. This corresponds to the side opposite to the ear which is to be operated upon, the surgeon always standing on the side of the operated ear. The instrument table should be covered with a towel. Another table should be arranged with two bowls, one containing a solution of lysol, 1 drachm to the quart; and the other, a solution of bichloride of mercury, 1 to 5000.

To the right of the head of the table a seat should be placed for the anesthetizer, and somewhere near this seat a very small table should be placed to hold his apparatus.

The dressings should be placed on one side, and the packages of gauze and cotton which are to be used during the operation should be opened and placed on a table by the side of the surgeon.

An adjoining room should contain material for the sterilization of the hands—a clean scrubbing brush, a quantity of tincture of green soap, plenty of hot water, and a nailbrush. The method of sterilization of the surgeon's and nurse's hands has been described at length in that part of this book which deals with "Preparation of the Nurse and Surgeon in Nose and Throat Operations," (page 267) The general duties of the nurse during an operation, as well as her surgical conduct, are also described in the same portion of the book. To these pages the nurse is referred for information on these points.

CHAPTER IV.

TREATMENT OF PATIENT AFTER OPERATION.

Recovery from the Anesthetic—Powders—Dressing External Ear—Dressing After Paracentesis—Dressing After Mastoid Operation—Dressing After Furunculosis—Dressing After Ossiculectomy—Dressing After Leeches.

Recovery from the Anesthetic.

During the recovery from ether the patient should be left undisturbed unless continuous vomiting supervenes, and then disturbed as little as possible. If continuous vomiting threatens to cause bleeding or displace sutures, then as soon as semiconsciousness returns and the patient is able to swallow, a quantity of hot water may be administered; this hot water should be followed by a quantity of lukewarm water or by the introduction of a finger into the pharynx of the patient, so as to induce gagging and vomiting. The result of this is to eliminate very rapidly from the stomach a large quantity of ether which has been swallowed during the operation. If the patient refuses to vomit a stomach tube may be used and the stomach washed in the usual way. Many physicians do not use this method, but allow the patient to rest quietly until they have entirely recovered from the anesthetic. After entire consciousness has returned the patient may be given small quantities of plain hot broth or hot water, and after four or five hours a larger quantity may be administered. Sleep should be encouraged and the room kept quiet and dark.

The Powder Blower.

The use of the powder blower, but more especially its care, is a duty which pertains to the nurse. As the powder blower is used quite often and ordinarily left exposed, it is necessary to speak of its care, since it may be an object of infection in an otherwise perfectly sterile technique. The powder blower before it is filled should be washed with alcohol, and all of the parts used to project the powder should be soaked in 95 per cent. alcohol. From this it should be removed by sterile hands and allowed to dry in a warmed, sterile pan. When the alcohol is completely evaporated and the bottle and blower parts are dry, the antiseptic and sterile powder to be used may be introduced.

It is now ready for use, but when unused should be kept carefully enveloped by a sterile towel, and after each use the end which has been near the ear should be immersed in alcohol and afterward allowed to dry. It is not necessary to sterilize the powder or the receptacle of the blower each time that it is used, but great care must be exercised with the tip.

Dressing After Ear Operations.

DRESSINGS AFTER OPERATIONS ON THE EXTERNAL EAR.

For plastic work upon the external ear the dressings will, under all circumstances, be left entirely to the physician, who will make all the dressings until the case has progressed far enough not to need anything but ordinary surgical nursing. For the dressing of plastic operations it is necessary for the nurse to have ready solutions such as will be designated by the attending surgeon, or, if they have not been specially mentioned, a normal saline solution, 1 drachm of salt to a quart of water; a solution of lysol, 1

drachm to a quart; and a solution of bichloride of mercury, 1 to 5000, are ordinarily used. There should also be a supply of sterile cotton, some pads of gauze, and several bandages $2\frac{1}{2}$ inches wide. For most plastic work rubber plaster is used, and a quantity of this should always be on hand. The rubber zinc oxide plaster is the best. Rubber adhesive plaster may be sterilized by passing the cut strip through an alcohol flame—plain cloth side next to the flame and the adhesive side uppermost, or the strip may be cut the desired width and length, laid on a glass plate, put in a box, and exposed for one hour to formaldehyde gas. The strip after sterilization may be rolled with sterile hands upon glass rods.

DRESSING AFTER INCISION OF THE CANAL OF THE EAR,

In these instances (paracentesis operations) a douche is required, which should be prepared and administered as has been indicated on page 198. After the irrigation of the ear the canal is dried with bits of sterile cotton, and a dressing applied within the canal. Some surgeons use as a dressing for the canal a bit of sterile cotton about 1 inch long and of sufficient caliber to fill the canal. Some use this plain, others cover the surface of the plug with a 10 per cent. solution of boroglyceride in glycerine; and others with a solution of ichthyol and glycerine, 1 drachm to the ounce. A few otologists do not use cotton at all, but depend upon gauze packing within the external ear. For this purpose plain gauze, boracic acid gauze, or iodoform gauze may be used. After a paracentesis operation (cutting of the eardrum) it is not necessary to apply any external dressing unless it is especially ordered. Then the entire ear may be enveloped with absorbent cotton held in place with a gauze bandage.

DRESSING AFTER MASTOID CASES.

The greatest care is necessary in mastoid dressings to keep everything sterile, so that no contamination of the wound may occur after the operation. The nurse should have ready for the visiting surgeon a variety of dressings, a quantity of hot water and green soap, and a sterile hand-brush; a quantity of plain, sterile water; a basin of sterile salt solution, and a third basin with a quantity of bichloride of mercury, 1 to 5000. The instruments after sterilization may be used dry, or may be immersed in a solution of lysol, 1 drachm to the quart. The dressings should be sterile, and usually consist of a quantity of absorbent cotton rolled into little sponge balls; some loose cotton; several folded pads of plain gauze; tubes of iodoform gauze or of any other medicated gauze which the surgeon may indicate; a sterile powder blower containing iodoform or aristol; and a few gauze bandages, 2½ or 3 inches wide.

After the surgeon has cleansed his hands, the nurse with her bandage scissors should remove the gauze bandage and also remove the dressings or second layer of gauze pads which cover the wound. The rest of the dressing should be left to the surgeon. He will now remove the remainder of the gauze and expose the mastoid wound.

A quantity of sterile solution should now be handed the surgeon with a few cotton sponges with which to wash off the skin of the mastoid before removing the gauze packing. The solution should be either sterile, plain, or saline solution or bichloride, 1 to 5000. Before the gauze packing is removed from the wound, the canal of the ear should be irrigated with a normal saline solution and the entire external ear cleansed. After the canal of the ear has been irrigated, it may be wiped dry by means of sterile cotton

upon an applicator. The gauze packing in the wound should be removed with forceps, and the wound should be irrigated with one of the solutions which the surgeons may choose. The best solution for this purpose is probably a normal saline solution. At the moment of irrigating, the nurse should lift the cartilaginous part of the external ear upward and forward in such a way as to open the wound. After the washing is performed, the head of the patient is tilted in such a way that the fluid runs out of the mastoid region. The whole surface is then dried with sterile cotton wrapped upon applicators, or by inserting a few strips of sterile gauze, which readily absorbs the water in the wound.

When the wound is dried, iodoform or aristol should be blown upon the granulations, only using enough to cover the granulations. Strips of iodoform gauze half an inch wide are now handed to the surgeon, who proceeds to pack the mastoid cavity, so that all the parts may be equally filled and the pressure upon the granulations equal in all parts. If the pressure is unequal, granulations will spring up in one part faster than in another and will leave a pocket which may afterward form a sinus. The first gauze should be introduced upward and forward into the mastoid antrum and the gauze should be packed upon this first piece forward over the upper surface of the wound, until the region of the lateral sinus is reached. At this point care should be taken that the probe which is used to pack the gauze does not tear the sinus. At this stage of the dressing the patient's head is usually held by the nurse. After the antrum and sinus regions have been covered with gauze, the rest of the wound cavity is packed from above and inward, until the whole cavity is filled evenly with gauze. The incision through the skin should be firmly packed, so as to keep it open as long as possible.

Some otologists now introduce a bit of cotton or gauze into the external ear, after the manner described under "paracentesis." If this is done, the gauze or cotton is introduced within the external canal as far as the drum, but is packed without any pressure. Folded gauze should now be laid upon the ear after the mastoid cavity has been packed, a strip of iodoform gauze may be laid upon the surface, and over this a layer of plain gauze to cover the entire ear. The first pad of gauze may be slit perpendicularly and the ear placed within the slit, so that the gauze will extend in front and behind the ear, the ear itself projecting through the cut in the gauze. The remainder of the gauze is simply laid upon this. If a thick dressing is desired, cotton is now applied, and the whole secured in place by a bandage properly applied.

The *mastoid bandage* is a figure-of-eight bandage which covers the entire ear and mastoid region on the side of the operation. The bandage begins over the ear on the side opposite the operation. The first loop runs backward around the neck, over the operated side to the forehead, here the bandage is "turned" on itself and continued backward in the same manner, coming back over the operated side, the fold is carried over the top of the wound and low down over the forehead, the next time the bandage is carried near the lower part of the mastoid region and high up on the forehead. Thus the dressing is covered first by one turn lower down, then by one higher up, while over the forehead the low turns over the operated side take a higher position while the high turns over the operated position take a low forehead turn. The bandage above the good ear is kept narrow. The bandage should be applied tightly.

This procedure is repeated every day if the case is discharging, or every second to fifth day, if there is little

or no pus. As the wound heals it must be made to heal from the deep part to the surface, otherwise pockets will form resulting in fistulæ which will continue to discharge for a long time. It is possible that they may become infected and produce still further trouble, sometimes necessitating a second opening and curetting of the region which has been partly filled with infected granulation tissue.

The duration of healing after a mastoid operation is from six to thirteen weeks.

DRESSING AFTER FURUNCULOSIS.

When a furuncle or boil has been incised it should be dressed after the manner described in this book under the title "Dressing after Paracentesis." It is, however, the general rule for the packing to be saturated with a 10 per cent. solution of boroglyceride. This favors the exudation of leucocytes and serum, and tends to promote healing.

DRESSING AFTER OSSICULECTOMY.

In this operation two or three tiny bones within the middle ear have been removed. In such cases free drainage is quite necessary and irrigation is of great importance. The tympanum and ossicles having been removed, the internal ear may be impinged upon by the solution used in irrigating, and considerable dizziness or vertigo result. As a rule, after ossiculectomy the ear should be irrigated every third day, and dressed with a narrow strip of iodoform gauze placed within the external canal, to prevent blocking of the canal and to facilitate capillary drainage. In cases where discharge has not been present before the ossiculectomy operation was done, it is not necessary to irrigate or to dress the wound so frequently. In such cases,

after the hemorrhage is stopped, iodoform gauze should be applied loosely within the canal of the ear, where it will furnish drainage for a couple of days. It should be removed, however, and the wound washed, upon the slightest increase of temperature. After washing, it should be repacked without pressure, the gauze acting simply as a wick drain.

DRESSING AFTER LEECHES.

After leeches have been placed upon the ear, hemorrhage should be favored by the application of hot water or by means of dressings wet in hot water for the first hour or two. After this, the wounds may be washed with a 1 to 5000 solution of bichloride, and some sterile pads placed over the leech bites. The whole should be secured with bandages. This is particularly useful where it is desired to continue the bleeding from the wound, and the dressing may be renewed as often as it becomes saturated with blood. In other cases where leeches have been applied, the hemorrhage ceases rapidly, and then the bites may be washed and dried and some flexible collodion afterward applied with a brush.

In a few cases in my experience difficulty has occurred from continued hemorrhage. Pressure should then be made upon the leech bites by a properly adjusted gauze bandage. If this does not succeed in stopping the hemorrhage, the application of some styptic—such as chloride of iron, powdered alum, or solution of adrenalin chloride, 1 to 1000—will succeed in producing a cessation of the bleeding, after which the case may be dressed as above described.

CHAPTER V.

EAR NURSING IN SPECIAL DISEASES.

Cerumen—Cutaneous Eruptions—Atresia of Canal—Foreign Bodies in the Ear—Paracentesis—Chronic Catarrh of the Middle Ear—Acute Middle Ear Inflammation, Catarrhal or Purulent—Chronic Purulent Inflammation of the Middle Ear—Treatment of Adenoids—Treatment of Deafness—Nurse's Duty in the Mastoid Operation—Ear Polyps.

Impacted Cerumen, or Wax in the Ear.

For this condition the nurse will be directed to introduce some drops within the external canal, thus softening the cerumen and facilitating its removal. Unless special treatment is ordered, the nurse is justified in using a full strength solution of peroxide of hydrogen, or what is known as a soda-glycerine solution, composed of equal parts of bicarbonate of soda, water, and glycerine. Either the peroxide or the soda and glycerine solution is introduced into the external ear with a medicine dropper, and when the ear is filled the solution is held within the ear by turning the head to the opposite side. After a few moments the wax will soften considerably and may be removed with an ear douche. When the wax has been removed, the nurse may look into the ear and will often be able to distinguish the drum glistening at the end of the canal. This will indicate that all of the cerumen has been removed. After drying the ear, a small piece of absorbent cotton should be introduced within the canal and left in place for twenty-four hours. If the inspection of the ear shows the presence of more wax, it is necessary to continue the douching until

this is removed. In a very few cases the cerumen will not be removed by the douche, and it is necessary to use an ear spoon. This should always be done by the physician, and not by the nurse.

Cutaneous Eruptions in the Region of the Ear.

Certain cutaneous eruptions are common on the skin in the region of the ear. The treatment generally consists in the application of lotions or salve, for which general orders as to method of the application will always be issued by the attending surgeon. As a rule, however, it may be said that lotions should be applied by means of pledgets of cotton soaked in the solution and applied over the region affected. After using the lotion the skin may be left uncovered, when the lotion will dry upon it, or it may be covered with absorbent cotton and a bandage. When salves are ordered for the skin of the ear, they should be rubbed for a few moments into the skin. Then a thin layer of salve should be applied over the affected area with a flexible steel knife, and covered with a thin layer of gauze bandage.

Atresia of the Auditory Canal.

In cases of closure of the canal special orders will be given by the surgeon. These will depend upon the character of the closure. Should it not be a bony atresia, a firm plug of spongy wood or of compressed cotton will be introduced after the operation. If the closure of the canal is from follicular inflammation or periostitis, the surgeon will probably order a twisted pledget of cotton soaked in some medicament placed within the ear. A medicament very commonly used is a 5 per cent. solution of boroglyceride in glycerine.

Foreign Bodies Within the Ear.

In cases of this kind, particularly when living bodies such as fleas or flies are within the external ear, it may be necessary for the nurse to act as if in an emergency and do something to prevent the activity of the insect, for frequently serious constitutional symptoms arise from their presence. Almost all foreign bodies may be removed by means of a douche, which should be administered through a syringe, so that a stream of considerable force may be obtained. Before the douche is used it is well to fill the external canal with glycerine or olive-oil or sometimes alcohol. These liquids, working past the foreign body, tend to float it out, so that it can be more easily expelled by the douche. After a few moments a syringe containing a normal saline solution or plain hot water should be used, injecting the fluid into the canal with considerable force. This will often dislodge the foreign body, and it will drop into the pus basin held to catch the water.

In the removal of foreign bodies it is well to remember three cardinal points:—

First.—If the object is not at once washed away, the patient should be placed on a table lying on his side, so that the ear containing the foreign body is lowest. In this position it is often more easily ejected by the syringe than in the sitting posture.

Second.—It must be remembered that certain vegetable materials—seeds, etc.,—quickly absorb water and increase in size. This renders their removal from the small canal almost impossible without the use of an instrument. If the history of the case shows that the foreign object is of vegetable matter, such as a pea or bean, no water should be used, but alcohol should be substituted as an irrigating fluid.

Third.—When living objects are within the external ear, they are frequently caught in the cerumen and die. Sometimes they remain alive and crawl against the drum. In this situation they produce distressing and painful symptoms—great pain in the ear, severe headache, convulsions, and vomiting. Before these objects are treated in the usual way, it is necessary that they be killed. This may easily be done by filling the ear with olive-oil, which soon suffocates the insect. The subsequent treatment consists in irrigation with water. If the object is very active, it is well to introduce a mixture of chloroform and olive-oil in the proportion of ʒi-iv. This narcotizes and then kills the insect, after which it may be removed in the usual way.

Larvæ are sometimes deposited within the ear in unconscious patients and are not noticed until they have hatched and appear as living objects in the canal. They may be killed instantly with a mixture of oil of turpentine and sweet oil, in the proportions of 1 to 10. They should then be expelled by hot-water irrigation.

Paracentesis.

This operation consists in making an incision through the drum of the ear through its posterior part for the purpose of allowing secretion to escape from the middle ear. The surgeon requires for this operation a knife, an ear speculum, several applicators wound with pledgets of cotton of small caliber, some peroxide of hydrogen, and a Politzer bag for inflation.

The nurse's duties during this operation are to arrange the instruments and to hold the head of the patient fixed and firm in case it is decided not to use an anesthetic other than cocaine. This operation is very painful unless done

under general narcosis, but the pain may be lessened if cocaine is used freely for about fifteen minutes before the operation. The cocaine is applied by means of pledgets of cotton, or it is dropped directly into the ear. When the ear is cocainized, the nurse should hold the forehead of the patient in one hand and the occiput in the other in such a way that the head will be immovable. The patient will manifest considerable pain and will probably spring from the chair when the drum of the ear is perforated with the knife. The nurse should guard against this movement by firm pressure. No douching should be used after the ear-drum has been cut, for the result of this would be to introduce more liquid into the middle ear than is already present, and there would be a tendency to drive the pus toward the mastoid cells. Instead of douching, the Politzer bag should be used. The air entering the Eustachian tube and middle ear removes the secretion by blowing it through the incision.

Chronic Catarrh of the Middle Ear.

For the treatment of chronic catarrh of the middle ear, the nurse should ordinarily have ready for the physician a Politzer bag, any instruments which the surgeon may bring, particularly small syringes for the injection of medicaments through the drum into the middle ear, and bougies for introduction through the Eustachian catheter into the middle ear for the treatment of the middle ear or the mucous membrane of the tube.

The nurse may be ordered to prepare these bougies. If they are used plain, they should be sterilized by washing in plain water, after which they are dipped in a solution of lysol, wiped again on a piece of sterile gauze, and laid upon a dry cloth. Sometimes the surgeon will wish the bougies to

contain a certain quantity of silver. Silver was a favorite treatment in the Vienna clinic and is used rather extensively in other places. To make what is called a "silver bougie," they are placed in a 4 per cent. solution of nitrate of silver, in which they remain for a week. At the end of that time the material of the bougie has been thoroughly permeated with the silver solution. The bougies are then removed from the silver solution and dried in the open air. Such a bougie will then contain a quantity of nitrate of silver, which will exert its beneficial influence upon the middle ear when it is moistened by the discharge from that region.

Stricture of the Eustachian Tube.

This ordinarily complicates catarrh of the middle ear, and is treated with plain or with silvered bougies or by electrolysis. In the electrolytic treatment the catheter, which is introduced into the Eustachian tube, is carefully wrapped with rubber tissue for insulation. The gold bougie is run through the catheter to its end, from which it very slightly projects. The catheter is then engaged within the mouth of the Eustachian tube, into which the end of the bougie is then passed. When the gold bougie has been passed to the region of the stricture, the negative pole of the battery is attached to the end of the bougie and the positive pole is attached to a sponge placed upon the patient's wrist. The current is slowly turned on until the milliampèremeter measures 5 milliampères. The duration of each treatment is generally for five minutes.

Acute Inflammation of the Middle Ear.
Earache.

There are two classes of acute inflammations of the middle ear—one known as catarrhal, where the discharge

is of a mucoid nature; and another, purulent, in which the discharge consists of pus. The treatment of both classes is much the same, but differences of treatment may be indicated by the attending surgeon. The nurse's duty in these acute diseases of the ear consists in carrying out given directions to relieve pain, to drain the ear, and to produce a cessation of the discharge. For the relief of pain it may be necessary to introduce ear drops of one kind or another. Before the drops are introduced within the ear, the bottle in which they are held should be placed in a cup of hot water so that the drops may be properly warmed. They are then sucked into a medicine dropper and the affected ear is filled with the warmed liquid. Cold solutions are liable to increase the pain.

When the ear has been filled with the warm drops a piece of cotton is inserted within the ear to prevent leakage. The drops are generally introduced as often as every hour, but may be introduced as often as every ten or fifteen minutes if the pain is very severe. The ear bath or ear douche is also useful for the relief of pain. When the ear douche is used in this class of cases it should not be for over ten or fifteen minutes. The prolonged effect of hot water within the ear is to soften and macerate the drum, which, of course, is undesirable. The temperature of the water for the ear douche should be from 102° to 106° or 110° F. The difference of 8 degrees between these extremes is the natural difference which results from the varying tolerance of the patient for heat. The rule should be to use the water as hot as can be borne by the patient without increasing the pain.

After the ear douche has been given, the ear drops are introduced as described above, and finally a piece of cotton fills the canal. The case may then be left without

further treatment until the next douche is ordered; or it may be necessary to use heat constantly in the form of moist hot gauze laid upon the ear or a rubber bag filled with hot water, upon which the affected ear should rest. If hot-water cloths are used, they may be wrung out in plain hot water, or if there is evidence of much redness in the ear and surrounding parts they should be wet with hot lead and opium solution. The severe pain in the ear is sometimes not controlled by this method, even when strong anesthetic ear drops have failed.

The best ear drops to use in cases of severe pain are of a 10 per cent. solution of cocaine muriate with a 4 per cent. solution of resorcin. This solution, of course, should be used warm and may be introduced as often as every fifteen or thirty minutes. In a few cases it may be necessary to give the patient an injection of morphine; $\frac{1}{6}$ grain should be the first dose for an adult.

Otologists are very apt to establish drainage through the Eustachian tube in both catarrhal and purulent inflammations of the middle ear, by forcing open the tube with an air current from a Politzer bag or by incision of the ear-drum. The treatment by politzerization and the relief of pain by means of ear drops, douche, etc., is a treatment which is used before the membrane ruptures. After the membrana tympani (drum of the ear) is ruptured, and the fluid of the middle ear allowed to escape, the treatment is often changed. The attempt on the part of the otologist is now to prevent infection of the ear and to cure the middle ear as quickly as possible. The treatment therefore will consist of a warm douche of boracic acid saturated solution —used as described under "Ear Douche," but in cases where the drum has been ruptured it is important to use but a weak stream of water, as too much force is apt to cause pain.

After the ear douche has been used it is customary to introduce some ear drops within the canal. A favorite formula for this consists of cocaine, 2 per cent., in adrenaline solution. Another favorite formula is a solution of morphine sulphate, 3 to 5 per cent.

As soon as the pain has ceased—and this generally occurs as soon as the drum of the ear is ruptured—an anesthetic solution is no longer required, and an antiseptic solution should be substituted. Such a solution is made of 4 per cent. resorcin, or a 1 to 10,000 bichloride of mercury. When the drum is ruptured, the use of the Politzer bag should be discontinued.

A few otologists still recommend what is known as the dry treatment for cases after the ear drum has ruptured. The dry treatment consists of carefully wiping out the discharge from the ear until the canal is thoroughly clean, after which the entire canal is filled with dry, sterile boracic acid. This is removed the next day or the day after, or as soon as it is soiled with the discharge, and by the same method of wiping out the canal. When the canal is again clean it is refilled with the dry boracic acid. In this method no irrigation whatever is used and no drops are introduced within the ear.

Peroxide of hydrogen is a remedy which the author believes should never be used in cases of catarrhal or purulent inflammation of the middle ear when the cases are acute; still it is a remedy which is often ordered by the otologist to be used warm within the ear as ear drops.

Finally the attention of the nurse must be called to the fact that the presence of adenoid vegetation (enlargement of the third tonsil) is seldom absent in cases of children having discharge from the middle ear, and frequently the discharge will not cease until the adenoids have been removed.

It is hardly the nurse's duty to attend to the adenoids, but in case their possible presence has been overlooked and the nurse finds that the child is a mouth breather—particularly at night—it might be wise for the general good of the patient to suggest their presence, as a possible cause for the continuation of the discharge—particularly if the attending physician seems to have forgotten this point.

Chronic Purulent Inflammation of the Middle Ear.

In cases of chronic purulent inflammation of the middle ear the nurse may be ordered to douche the ear, and in a few cases may be intrusted with the use of the Politzer bag, for the purpose of driving the secretion from the middle ear through the perforation of the drum into the external ear, so that it may be removed by washing. The method of politzerization has already been described.

There are a few special points which may be mentioned in discussing irrigation of the ear in these cases of chronic discharge. One of these is the danger of producing vertigo from the pressure of water upon the labyrinth of the ear. When there is a large perforation in the drum, if the douche is used with too much force, the water may be injected through the opening of the drum and make pressure upon the labyrinth. Immediately the patient will be seized with headache and vertigo, which may be slight or may be so severe that he will fall unconscious from the chair—or will only be prevented from falling by holding firmly with both hands on some object. This may be avoided by lessening the pressure of the syringe or by lowering the level of the douche bag.

Attention should also be paid to the frequency of irrigation, to the temperature and specific gravity of the water,

to the force of the current, and to the medicaments which are to be used for irrigation. The temperature of the water should be from 102° to 106°; the force of the injection should be that fall which is produced by raising the douche bag about three feet above the patient's ear; the strength of the solution should be from ½ to 1 per cent., if it is a saline solution; but if a solution of boracic acid is used it should be saturated. Other medicaments are usually ordered to meet particular indications. They are ordinarily solutions of lysol, 1 per cent.; creosol, 12 per cent.; formalin, $1/10$ of 1 per cent.; bichloride of mercury, 1 to 5000. In cases where the odor is bad, sometimes instead of the bichloride solution potassium permanganate solution, 1 to 2000, is used for deodorization. If peroxide of hydrogen is used in these cases, it should be used in the proportion of 1 to 10. In a few cases, where the discharge is very abundant, as well as thin and watery, the best irrigation consists of a solution of oil of turpentine in the proportion of 15 drops to a quart of water.

After the ear has been politzerized and then douched it must be thoroughly dried by means of pledgets of cotton introduced within the canal. When all the water has been dried from the ear it is ready for the physician, who will then apply any special treatment that is indicated. This is ordinarily either a powder or a caustic treatment, or the use of certain astringent remedies. If a powder is used after the cleansing it may be of plain boracic acid, iodoform, iodol, resorcin, or aristol. These may be used plain or mixed with certain other powders which serve as diluents. Drops are employed sometimes instead of powder. These may be used after the manner described in the discussion of ear drops, and are peroxide of hydrogen; a solution of mercury bichloride in alcohol, 1 to 5000; an ichthyol solu-

tion; or plain alcohol. If the physician decides to employ the caustic treatment, which is the one ordinarily applied to reduce granulation tissue within the middle ear, he will probably use nitrate of silver, which he will apply as a small bead fused upon a probe or else in a cauterizing solution of 60 grains to the ounce. In a few cases other cauterants are used—trichloracetic acid, lactic acid, and the galvano-cautery are the favorites. When an astringent remedy is ordered to be used after a douche, it will ordinarily be a solution of silver nitrate—10 grains to the ounce; zinc chloride, 2 grains to the ounce; copper sulphate, 10 grains to the ounce; alum, 20 grains to the ounce; or alumnol, 20 grains to the ounce.

Some otologists, in addition to these methods, treat the middle ear with a syringe having a fine silver cannula. The syringe is filled with the medicament desired, which is generally one of those mentioned above, and by means of a good illumination and an ear speculum the cannula is introduced through the perforation of the drum and the cavity of the middle ear is thoroughly medicated.

Treatment of Adenoids.

In most cases of chronic inflammation of the middle ear, especially in children, it may be taken for granted that the presence of adenoid tissue in the naso-pharynx is one of the elements in keeping up the discharge. The nurse's duty in adenoid cases, before, during, and after the operation, has been discussed in that part of this book which deals with that subject. The fact of their possible existence should not be forgotten, and the child who has ear discharge should be carefully watched for the ordinary symptoms of adenoids, which are mouth breathing, snoring, and nasal discharge.

Treatment of Deafness After Ear Discharge has Ceased.

The cases of chronic purulent inflammation of the middle ear result in more or less impairment of hearing. There is generally some retraction of the drum, and for the treatment of this resultant condition politzerization, massage of the drum of the ear, or the use of an artificial drum are the means ordinarily used to improve the hearing. Massage of the drum is a favorite method of treatment with many otologists, and is carried out with very simple or very complex apparatus. All of the instruments used to apply massage to the drum act by producing a vacuum and then a condensation of air in the external ear. By means of this the drum is drawn toward the instrument or pushed away from it, slowly or rapidly, as the air is exhausted or compressed. In this way the drum is moved from its position backward and forward, and small adhesions within the drum, or from the drum to the middle ear, are ruptured, and the elasticity of the drum improved. The circulation of the middle ear also seems to be improved by this alternating rarefaction and condensation of the air.

The simplest method of accomplishing this purpose is by means of the Siegel otoscope, which is fitted closely to the borders of the canal of the external ear while compression and suction is made upon the bulb, held in the hand. The effect upon the drum is observed through the glass window in the otoscope.

The treatment by means of a pump or cylinder is applied upon the same principle, and is much more satisfactory and certain in its results. This pumping apparatus may be driven by a pedal and belt attachment or by means of an electric current.

In another class of cases where the drum has sloughed away, or is absent from other causes, the use of massage is contra-indicated. In these cases, after the discharge has ceased, the patients hear better if an artificial drum is introduced. The best form of artificial drum consists of a small circle of flexible rubbber or silk carrying in the center a metal rod so that it may be easily removed. Sometimes these drums do not act as well as the introduction of a small piece of cotton rolled into the form of a ball and placed in the external ear at the old position of the drum. Care must always be taken to have the cotton sterile and to roll it into shape with sterile fingers.

Nursing in Mastoid Cases.

In the operative treatment of chronic purulent discharge of the middle ear the nurse may be called upon to assist in an operation for paracentesis; or she may be called upon to treat the ear after the canal has been incised, according to the method previously described under "Furunculosis"; or she may be called upon for aid in a mastoid operation. The preparation of the patient and of the room is described in Chapter III of this part.

In any case of disease of the ear when involvement of the mastoid is suspected the nurse's duties are of the highest order of importance, and she must apply the treatment indicated conscientiously and regularly. She must carefully observe the patient's symptoms, particularly those which will be described hereafter as unfavorable symptoms. These must be carefully charted and upon their earliest appearance must be fully reported to the attending physician. As soon as mastoid disease is suspected, a coil for the application of either heat or cold may be ordered. This coil is used after the manner described in Chapter II of this part

under discussion of the ice coil. If heat is ordered, the methods of employing it are discussed under "Hot Medicinal Applications," in the same chapter.

Leeches are very frequently ordered very early in mastoid involvement. Their use has been discussed in Chapter II of this part.

Some cases of mastoid involvement subside without developing a condition which requires operation, but a number of cases will require opening of the mastoid cells. Operations in the mastoid region are either a partial operation, which involves opening of the cells and their curettage, or a radical operation which involves the entire removal of the cells as well as of the structures within the middle ear. The anatomical details of this operation need not concern the nurse, but her especial duties are practically the same in either case.

When the mastoid cells are to be opened, her first duty is to see that the room is properly prepared, and that the proper dressings and sterile coverings are provided and placed in the operating room. (See Chapter III.)

Her next duty is to see that none of the necessary instruments have been forgotten, for in mastoid work time is an important element and the work cannot be properly carried out unless the requisite instruments are at hand. In many operations it is possible to improvise instruments or to substitute one instrument for another, but this is not possible in mastoid work. The nurse should therefore see that upon the instrument table are placed chisels—straight and gouged, a scalpel, mallet and periosteal elevator, retractors—sharp and blunt, artery clamps, dressings, forceps, and curettes. A special instrument known as the Stacke protector is also convenient when the middle ear is to be entered. Besides these, there should be silk, needles, probes,

cotton sponges, and solutions, general directions for which have been given in Chapter III of this part. The instruments should be sterilized in boiling water for thirty minutes. All sharp cutting instruments, such as knives and scissors, should be immersed in alcohol, wiped with gauze wet with alcohol or ether, and placed dry upon the table.

The preparation of the patient has been described in Chapter III of this part.

After the operation has been completed, irrigation, iodoform or plain gauze, gauze pads, and a bandage will be necessary. The first dressing is generally made by the operating surgeon, but the nurse may be requested to adjust the bandage. A proper bandage for mastoid cases should begin on the side opposite the operation, pass forward over the forehead and operated side, pass to the occiput, and then forward to the point of starting, in this way encircling the head. As few folds of the bandage should be used as will be necessary completely to cover the field of operation. (See also Dressing after Mastoid Cases, page 224.)

THE NURSE'S DUTY AFTER THE MASTOID OPERATION.

The temperature of the patient must be carefully watched, and if necessary it should be taken in the rectum. The nurse must watch other symptoms, particularly if their advent indicates a bad condition of the wound or the development of some complication. Profuse secretion after mastoid operation is a bad symptom, indicating that the entire focus of disease has not been removed or that bacterial infection is going on unhindered by the operation. After mastoid operation the temperature should drop to normal or nearly normal, and should run along with a slight evening rise not above 99° F. for the first week after the opera-

tion. It should then reach the normal point and remain there.

If the temperature rises suddenly, it indicates a progression of the poisoning from the pus, or the development of a complication, which should be reported to the physician at once. Sometimes as soon as the temperature rises the patient will be seized with a chill. This usually means that meningitis is about to develop or that the lateral sinus has been infected. Headache and vomiting are other cerebral symptoms which are apt to follow a chill, and indicate, as does the chill, that cerebral complications are developing and that the situation is extremely grave. In a few cases erysipelas will develop as a wound complication. This is shown by the presence of swelling in the immediate vicinity of the mastoid, with a cessation of all discharge, or the substitution of a thin, watery, ichorous discharge, for the ordinary purulent discharge which follows the mastoid operation. Infection of the wound by erysipelas is accompanied by a chill and rise of temperature.

If none of these unfavorable symptoms which have been mentioned appear, the patient should be kept in bed and the bandage unchanged. At the end of the fifth day after the operation the wound should be dressed for the first time.

In preparing for the first dressing, care must be taken that everything is sterile. The nurse must be as particular in preparing the room and the material as she was at the time of the operation. The first dressing is more important than the subsequent ones, but for each dressing sterile material must be prepared, and opportunity given to the surgeon to cleanse his hands. Irrigating fluids and receptacles for solutions should be sterile, and care must be used not to carry infected material from the hair of the

patient into the wound. Ordinarily redressing is required every third or fourth day for a period of two to five weeks. At the end of five weeks the wound should have nearly healed, but it may require a longer time. For mastoid dressings a favorite plan of procedure is to irrigate the wound after wiping off the skin in the region of the mastoid. The best solution to use for irrigation is a bichloride of mercury solution, 1 to 10,000, or, if the wound is in first class condition, sterile water or sterile saline solution alone is necessary. After drying out the wound, iodoform gauze is gently introduced—or aristol or plain, sterile gauze may be substituted for the iodoform gauze, if it is desired. The wound is then covered with pads of sterile gauze. The pad next the ear is generally slit, and through this slit the ear is introduced, so that the entire external ear is surrounded by the gauze, and the other layers of gauze are packed upon this one. Over the whole, a quantity of absorbent cotton and a bandage are adjusted.

If the discharge from the wound is very profuse, so that the dressing is thoroughly wet through at the end of twenty-four hours, it is wise to change this dressing for a wet one. The best solutions with which to wet the gauze applied next to the ear are lysol solution, 2 per cent.; peroxide of hydrogen, full strength; or bichloride of mercury solution, $\frac{1}{10}$ of 1 per cent. Mastoid cases are slow to recover. Professor Politzer, in his work on ear diseases, states that healing in mastoid cases requires from one and one-half to nine months for a complete cure, and that the average case requires from three to four months to get well. In cases where abscess develops within the cranium, or where meningitis is present as a complication of mastoid disease, the nurse's duties are similar to those in an ordinary mastoid operation, except that the case partakes more of the character of a general surgical case.

Some of the symptoms which indicate the beginning of meningitis are chill, high temperature, headache, vomiting, alteration in the mental condition, with the development either of a slight grade of stupor which gradually increases to unconsciousness or else the development of an irritable mental condition with convulsions. The head is then to be covered with an icecap, leeches are applied to the cranium at the base of the brain, and purgatives—particularly croton-oil, 2 drops—or some other active purgative—are ordered. Most of these cases prove fatal, but the small percentage which recover are helped only by surgical procedure.

Ear Polyps.

In cases where the external ear contains granulation tissue—which afterward develops into ear polyps—it is ordinarily necessary to remove the polyp. This may be done by a method of snaring and curetting. The snare should be used if the polyp is small. After the polyp has been removed, the nurse should hand the operating surgeon some silver nitrate, which he will fuse upon a probe by holding the probe in the gas burner until it is heated and then dipping it into the powdered nitrate of silver, allowing the silver to melt upon the end of the probe. When this is cold it will form a small bead upon the end of the probe, with which the base of the polyp should be cauterized.

Sometimes instead of nitrate of silver the surgeon may order a caustic known as monochloracetic acid; and in a few cases he may use the galvanocautery.

The after-treatment for these cases consists in the use of alcohol. The effect of the alcohol is to heal the small areas of granulation tissue which may be left after the polyps have been removed. It should be introduced within the ear after the manner described under "Ear Drops."

Cases of Acute Hyperemia of the Labyrinth.

Cases of acute hyperemia of the labyrinth are very rare. They are accompanied by intense vertigo, and require absolute rest in bed with the head kept upon the mattress unsupported by pillows. The slightest movement of the head produces intense vertigo and vomiting. In such cases, the nurse will be instructed to use the ice coil or icecap, to administer a hot foot-bath, and sometimes to put leeches upon the mastoid. All of these procedures have been described under their various heads, to which the nurse is referred for fuller information. Purgation is likewise a valuable remedy. The directions for giving this will be issued by the attending physician.

In cases of Ménière's disease, where deafness, dizziness, and vomiting are the prominent symptoms, the nurse's duties are similar to those described in the preceding paragraph.

PART III.—NOSE AND THROAT.

CHAPTER I.

ANATOMY AND PHYSIOLOGY OF THE NOSE, NASOPHARYNX, AND LARYNX.

THE ANATOMY OF THE NOSE.

THE organ of the sense of smell is divided into two nasal chambers, the external and internal nose, as well as into two sides, separated by the nasal septum. The external nose is that part which is so prominent upon the surface of the face. It occupies only about one-tenth of the entire area of the nose. The internal nose extends from the margin of the cheeks, backward to the naso-pharynx. It is not a simple cavity, but has communicating with it several other chambers, distributed throughout the bones of the head, which are known as the accessory sinuses of the nose.

The external nose contains a space known as the vestibule, or entrance to the nose, which is continuous with the space of the internal nose.

The internal nose begins at the anterior end of the inferior turbinate body, and extends from the roof of the mouth below to the floor of the brain above and backward as far as the posterior end of the inferior turbinate body —the beginning of the naso-pharynx. The internal nose has on each side a roof, an inner wall, a floor, and an external wall. The floor of the nose is concave from the

front backward, as well as from side to side, the posterior end lying on a lower level than the anterior. The roof of the nose is very narrow, scarcely wider than the end of an ordinary probe. It is perforated with many foramina for the distribution of vessels and for the olfactory nerve. The internal or septal wall, in a normal specimen, is perpendicular, and is composed in front of a cartilage which is known as the triangular cartilage, while the posterior two-thirds are bony. These parts are known, respectively, as the cartilaginous and the bony septum. The external wall of the nose is not so simple in construction. At the floor, the external wall is farther away from the median line of the body than at the roof. This means that the space of the nose is greater at the floor than at the roof, due to the obliquity of the external nasal wall. The external nasal wall supports three bones, which are known as the turbinate bodies. The largest of these is the inferior turbinate body, and is attached to the external wall about 1 inch above the floor of the nose. It then curves inward and downward into the nasal space, and reaches within 1/4 inch of the floor of the nose. The middle turbinate body is attached to the wall 1 inch above the inferior turbinate body, but is shorter than the other, beginning on a line 1/2 inch posterior to it. Both of these turbinate bodies end at the same perpendicular line behind. The superior turbinate body, so called, although it is not a turbinate body at all, occupies the posterior part of the external wall. Unlike the other two turbinates, it is not detachable without breaking into other structures of the nose. It cannot therefore be termed a turbinate; it is really the inner wall of the posterior ethmoidal cells.

The presence of these three bodies on the external nasal wall produces a natural division of the nasal space into

three cavities, which are termed the inferior meatus, the middle meatus, and the superior meatus. The inferior meatus of the nose is the space between the floor of the nose and the lower border of the inferior turbinate body. The wall of the inferior meatus contains the opening of the lacrymal duct. This is the only opening into the inferior meatus.

The middle meatus of the nose begins at the lower border of the inferior turbinate and ends at the lower border of the middle turbinate. It is bounded on the inside by the nasal septum by a line drawn from the septum to the lower border of the inferior turbinate, and by the upper surface of the inferior turbinate. Externally it is bounded by the external nasal wall, and comprises a deep recess between the middle turbinate and the external nasal wall, into which so many of the accessory sinuses empty. It is bounded above by the external surface of the middle turbinate, and by a line drawn from the lower border of the middle turbinate to the nasal septum. About the middle of the middle meatus one finds a deep sulcus known as the hiatus semilunaris. This sulcus extends from above downward and backward. A probe passed through the upper end of the hiatus at once finds its way into the frontal sinus, while one passed at the posterior end of the hiatus enters the antrum of Highmore. Along the upper wall of the hiatus will be seen several openings,—as few as two or as many as six. These are the openings of the anterior ethmoidal cells, all of which discharge their contents into this region.

The superior meatus is bounded on the inside by the nasal septum; above by the roof of the nose; below by a line drawn from the lower border of the middle turbinate to the nasal septum and externally by the septal side of the

middle turbinate and that part known as the superior turbinate. This region contains the openings of the posterior ethmoidal cells, which open into the deep sulci,—generally two and sometimes three,—known as the ethmoidal sulci. Besides these, the sphenoidal sinus opens into the superior meatus at its posterior and upper part, in a region known as the spheno-ethmoidal sulcus.

The accessory sinuses of the nose are those cavities which communicate with the nose and increase the nasal area. They are (on each side) a frontal sinus, the antrum of Highmore, the ethmoidal sinus,—divided into anterior ethmoidal cells and posterior ethmoidal cells,—and the sphenoidal sinus. This makes a total number of eight sinuses, the surface area of which is much greater than the area of the main nasal cavity.

It is not necessary for us to describe these sinuses in detail, but it is well to repeat certain facts about them which it will be of advantage to the nurse to know. The frontal sinus is located between the two layers of the frontal bone and lies directly above the eyebrow. Its size varies considerably and it is often absent. It communicates with the nose through a small opening on its floor, which is known as the naso-frontal duct. This opens into the middle meatus of the nose in the sulcus known as the hiatus semilunaris. The posterior wall of the frontal sinus supports the anterior lobe of the brain, and this important anatomical relation makes disease of the sinus or operation upon the sinus a very difficult problem, on account of the possibility of infecting or penetrating the brain.

The antrum of Highmore is located under the eye in the body of the superior maxillary bone, and it is generally the largest of the accessory nasal cavities. It is pyramidal in shape, with its apex reaching out into the cheek (malar)

bone. The base of the sinus is the external nasal wall, and the cavity of the sinus occupies a position in relation to the nose, so that it lies opposite both the inferior and middle meatus. Its lower boundary is the alveolar process, into which the roots of the teeth are fixed; its roof is the floor of the orbit. This cavity communicates with the nose by means of its antral orifice, which opens into the posterior and lower end of the hiatus semilunaris.

It will thus be seen that the openings of the frontal sinus and the antrum of Highmore are at opposite ends of the deep sulcus on the external nasal wall, in the middle meatus, which is known as the hiatus semilunaris. The important relation of the antrum is with the orbit, and care must be taken in the operations upon this cavity not to perforate the roof and enter the orbit. It also has an important relation to the infra-orbital nerve which lies in a canal on the antral roof.

The ethmoidal sinus is divided into two parts, known as the anterior ethmoidal cells and the posterior ethmoidal cells. The anterior ethmoidal cells open into the middle meatus of the nose, while the posterior ethmoidal cells all open into the superior meatus. The entire ethmoidal sinus extends from the posterior wall of the frontal sinus backward to the sphenoidal sinus. Its important relations are with the orbit, from which it is separated by a very thin layer of bone, and with the brain. The anterior lobe of the brain lies upon the roof of the ethmoid cells.

The sphenoidal sinus, located within the body of the sphenoid bone, is a large accessory nasal cavity, cuboidal in shape, which communicates with the superior meatus through the spheno-ethmoidal sulcus. It has important relations on its upper and outer wall with the optic nerve; the third, fifth, and sixth nerves; the Gasserian ganglia, and

a very important relation with the internal carotid artery and the cavernous sinus.

Anatomy of the Naso-pharynx and Pharynx. .

The naso-pharynx begins where the nose leaves off, at a line perpendicular to the posterior ends of the turbinate bodies, and extends in a curved line as a dome-shaped cavity backward and downward to the level of the hard palate. It contains normally on its lateral walls the openings of both Eustachian tubes and at its roof a certain quantity of adenoid tissue called the adenoid tonsil or the third tonsil or the pharyngeal tonsil.

The oral pharynx, described in a simple way is the space behind the mouth and contains the soft palate and the uvula, which laterally divides into two bodies, known as the anterior and posterior pillars of the fauces. Between these two pillars the tonsil is included, while the uvula lies at its upper part, extending downward in the median line.

The anterior part of the pharynx is open, communicating with the mouth. Its posterior part is a mucous membrane covering the scalenus muscles. Its lower part contains two openings: one into the esophagus, through which food enters into the stomach, and the other into the larynx, which conveys air to the lungs.

Anatomy of the Larynx.

The exterior or the frame of the larynx is composed of two large plates of cartilage joined together in front, known as the thyroid cartilage. These cartilages are united in front in the median line, but are separated widely behind, thus making an angular shield, which protects the interior structure of the larynx. The prominent part of

the thyroid cartilage may be felt in front of the neck, and is known as Adam's apple. The other cartilage which composes the frame of the larynx is known as the cricoid. This is located below the thyroid cartilage and is separated from it by a membrane known as the crico-thyroid membrane. The cricoid cartilages resemble a signet ring, with the face of the ring placed posteriorly. On the top of the wide part of the cricoid cartilage rest the two arytenoid cartilages that serve at their anterior part for the attachment of the vocal cords. The structures of the interior of the larynx are the epiglottis, the false and true cords, containing between them the vestibule of the larynx and the sinus of Morgagni.

The epiglottis is an ovoid plate of cartilage free above and attached below by ligaments to the tongue and to the thyroid cartilage on its posterior surface. It serves as a door to prevent food and foreign matter from entering the larynx. Its position is upright during phonation, but it is practically horizontal during the act of swallowing.

The false vocal cords are two bundles of muscle fibers placed on each side of the larynx. They have nothing to do with phonation except as they change the position of the true cords by acting on the movable cartilages of the larynx. The true cords are located below the false cords, and are attached to the thyroid cartilages on their respective sides and immediately next to the median line. They are attached behind to a prominent process on the anterior surface of the arytenoid cartilages, and are, like the false cords, bundles of muscle fibers. They differ from the false cords in possessing a few strands of fibrous connective tissue stretching from the arytenoid process forward to the attachment of the cord, thus making a slight edge on the surface of the true cord.

Between the false and true cords is a space known as the vestibule of the larynx, which is continuous with a small cavity lying between the false cords and the interior surface of the thyroid cartilage. This space generally extends to the top of the thyroid cartilage, and is known as the sinus of Morgagni, or the sinus of the larynx. The muscular structures within the larynx are covered with mucous membrane. The term "chink of the glottis" is applied to the space between the edges of the true cords during quiet respiration, and the term subglottic is applied to the region beneath the true cord.

Physiology of the Nose, Naso-pharynx, Pharynx, and Larynx.

The nose serves as a filtering medium. By means of the ciliated epithelium it entangles the dust particles and transfers them backward into the naso-pharynx. In this way the dust particles are prevented from entering the accessory sinuses; the hairs at the entrance of the nostril serve the same purpose, and prevent the entrance of flying insects. The nose supplies a large quantity of moisture by which the humidity of the inspired air is increased. This is a very important function, for air is rarely breathed humid enough to keep the air-vesicles of the lung in a moist condition, thus favoring the introduction of oxygen into the blood and the elimination of carbonic acid from it. It is estimated that nearly a quart of water is secreted from the nose in the course of twenty-four hours, but the mechanism is so delicately constructed and the balance so perfectly adjusted that under normal conditions not one drop of this escapes from the vestibule of the nose, for it is all used by the inspired air.

The nose is also a warming medium for the inspired air, and it is estimated that the temperature of the external air is raised nearly to the body temperature in the short time taken for the inspired air to travel from the end of the nose to the pharynx. The correctness of this observation may be doubted, but it is safe to state that the air is raised many degrees in temperature in its passage from the nose to the lungs. The nose also serves as a resonator for the voice, and modifies its character and tone. In this function the accessory sinuses are said to play a very important part.

The nose is also the organ of olfaction—the seat of the sense of smell. The nerves for this special sense are distributed through a small region on the mucous membrane of the superior turbinate and to a similar area opposite it on the nasal septum.

The functions of the naso-pharynx are respiratory, to keep the throat moist by the secretion of mucus, to provide for the aëration of the middle ear through the Eustachian tube, and to act as a resonator for the voice.

The pharynx, which is a continuation of the naso-pharynx, serves all the purposes of the naso-pharynx except that of ventilating the Eustachian tube, but in addition it is a part of the alimentary canal and conducts food into the esophagus. Parts of the nerve of the sense of taste are also distributed to the mucous membrane of the pharynx, so that it participates as an organ of the sense of taste. The larynx is an organ of respiration and of phonation. It receives the air, which is conducted from the larynx into the trachea. The larynx also furnishes mucus for the lubrication of its interior, and moisture and heat to the inspired air, but in a much less degree than the nose. It is also the organ for the production of voice.

The true vocal cords are the parts concerned in the formation of the voice. They are moved by eleven delicate muscles and are set in vibration like the reed of an organ by the air passing in expiration between them. The perfection and pitch of the voice depend upon the perfect adjustment of the cords. The quality of the voice depends upon the shape and size of the parts above the vocal cords, in the pharynx and in the nose.

CHAPTER II.

PREPARATION FOR OPERATION.

Local Anesthesia—Poisoning from Anesthetics—Prevention of Poisoning—General Anesthesia. Position and Preparation of Instruments and Apparatus: Illumination—Sterilization of Instruments. Preparation of Patient: Cleaning of External Parts—Cleaning of Nose—Douche—Cleaning of Mouth and Pharynx—Diet before Operation.

Local Anesthesia.

Operations on the nose and throat are sometimes done without anesthetics. We may assume that some method of alleviating the pain of operation will be used, either local or general anesthesia.

Local anesthesia is produced by application of medicine to limited areas, producing temporary paralysis in the terminal sensory nerves at the seat of application. The anesthesia may be complete or incomplete, different remedies producing varying degrees of anesthesia. The use of heat or cold is well known in surgery, and in simple throat operations or in the absence of better means cold may be used for amputation of the tonsils or the uvula, for the incision of abscess, and as an application to diminish pain after operations.

Heat is best applied by means of special apparatus which blows hot air into the nose or throat, or by a hot-water douche, the temperature of which should be greater than usual, 110°, 115°, or 120° F.

To produce any anesthetic effect from hot water it must be hot enough to induce sharp sensation of burning, which

soon subsides and leaves the membrane upon which it was used somewhat anesthetic.

Cold applied by douches of ice water, of a temperature from 38° to 40° F., in the nose or by pieces of ice held against the soft palate or tonsil or by icebag on the neck, produces a greater degree of anesthesia than heat, and its effects are more prolonged. Under the influence of cold, tonsillotomy, uvulotomy, and incision of abscess may be painlessly performed. Phenol-camphor, a mixture of ⅓ carbolic acid and ⅔ camphor, producing a non-irritating, colorless liquid, will induce sufficient anesthesia when applied to the throat on a cotton pledget and probe, to perform short operations. It is used when for some special reason cocaine is contraindicated. Solutions of carbolic acid (10 per cent.), menthol (4 to 8 per cent.), and the volatile oils are sometimes useful. Eucaine in 2, 4, or 10 per cent. watery solutions is, next to cocaine, the most useful local anesthetic. It is less stable than cocaine and its action is uncertain. It is used in a watery spray or on cotton pledgets. It is superior to cocaine only in laryngeal operations, for here it does not contract the tissue and diminish the bulk of the operating field. In nose work it does not compare with cocaine in general usefulness or applicability. Eucaine does not, however, produce any poisonous or constitutional symptoms. Novocaine in solution of ¼, ½, 1 or 2 per cent is used injected into tissues and produces a satisfactory and safe anesthesia. It is said to be non-toxic.

Cocaine anesthesia is obtained by spray, pledget, injection, and applications of the crystals of the drug. For anesthetic effects it is preferable to use watery solutions, as they are more diffusible. When oily solutions are used the alkaloid cocaine is used; not one of the salts. In watery solutions, hydrochlorate of cocaine is preferred.

The most satisfactory effects are produced by using varying strengths of the watery solution. Solutions of from 1 to 50 per cent. are used. Any degree of anesthesia may be induced. With a 1 per cent. solution anesthetic and contractile effects are produced in about three minutes. With stronger solutions the effect is observed quicker and the anesthesia is more profound. Total absence of all sensation is not possible. Patients are always able to feel the operating instrument upon the anesthetized part, so that patients insist that they experience a certain degree of sensation. It is certain that they suffer no pain. The duration of anesthesia depends upon the length of cocaine contact and the strength of the solution employed.

It is well to remember that the action of cocaine is strictly local and confined to the area to which the cocaine has been applied, and the slightest touch beyond this region produces pain. A thoroughly applied 4 per cent. solution will cause anesthesia for about three minutes, an 8 per cent. solution for about six minutes, and sometimes a 20 per cent. solution for a half-hour. Besides producing anesthesia, the cocaine shrinks all soft tissues by contracting the blood-vessels; this decrease in the quantity of blood diminishes the size of the tissue. It is well to remember this lessening of bulk, of at least one-half. Complete anesthesia for a long period could easily be produced were it not for one drawback—the production of general constitutional symptoms, which are unfavorable to the patient's welfare and are sometimes dangerous. These unfavorable omens indicate absorption into the general circulation of enough cocaine to produce poisonous symptoms. The earliest signs are a desire to talk, a lightheartedness, and a sense of well-being. The physician notices a brightened eye, an accelerated movement, and a quickened pulse, which becomes fuller

and increases in tension. At this stage, if the area of local application be examined it will be found blanched and entirely anesthetized. The increasing pulse-rate and tension are useful to indicate the complete anesthesia of the part desired, and the moment of complete anesthesia can be determined without local examination. If any cocaine flows over the upper surface of the soft palate or down the lateral pharyngeal folds, nausea and gagging are induced. A very common disagreeable symptom is a "ball in the throat." After the advent of these first indications of discomfort, in some cases, the cocaine ceases to produce other. But in a few people the unfavorable symptoms develop rapidly from this stage. The patient's face becomes pallid; the eyes dulled; there is a sense of extreme exhaustion and muscular relaxation, with a very rapid and weak pulse; nausea is induced; and the patient becomes apprehensive and restless, breaks out with a profuse, cold perspiration, and is unable to maintain the erect position. If the depression of the nervous system continues, the heart fails to act and the patient faints. After recovering from these acute symptoms, the patient remains weak, anxious, and nervous for twenty-four hours.

Prevention.—These unfavorable constitutional effects of cocaine may be prevented, or, in case they develop, may be suppressed by the administration of some diffusible cardiac stimulant. If these stimulants are used before cocainization the symptoms rarely develop. Whisky, *q.s.*; nitroglycerine solution, 1 per cent., 3 minims; tincture of digitalis, ♏vi-x; aromatic spirit of ammonia, ♏xv, used alone or, better, in combination, are extremely useful. A good formula to be given before cocaine is employed and one I generally give as routine is:—

℞ Sol. nitroglycerin,
Ext. digitalis fl. ....āā ♏ij.
Spts. frumenti .... ℥ss.

The nausea and gagging and frequently the vomiting are prevented by peppermint-water gargle or by an oily menthol spray in the pharynx. If fainting ensues, the prone position, with the head lower than the chest, and the use of the above-mentioned cardiac stimulants will in a few moments restore the circulation.

Morphine sulphate (1/6 grain) administered hypodermically is a fairly sure remedy to prevent toxic symptoms from cocaine if used one-half hour before the cocaine is used. It is also an antidote to the poisonous symptoms when they develop. As routine practice we give morphine sulphate 1/6 grain to every case which is to have cocaine anesthesia and we never see cocaine poisoning. This is true, however, only when the cocaine is not injected.

General Anesthesia.

Nitrous oxide (laughing gas) anesthesia is not often employed in throat cases except in adenoid operations. It requires no special mention except to note that the mouth-gag must be introduced before the inhalation begins. The anesthesia is completely produced in sixty seconds, is not followed by any unfavorable symptoms, and is, in fact, the best form of anesthesia to use.

In ether and chloroform anesthesia there are a few points differing in its application to general surgery which the nurse must remember. No class of patients take anesthetics so poorly as children suffering from adenoids and enlarged tonsils. In these patients the nasal respiration is scarcely used, and in the early stages of ether rigidity the mouth and teeth are firmly fixed. As a result, these

cases breathe badly and cause some anxiety from restlessness and cyanosis. Frequently the jaws must be pried open and the gag introduced, or the tongue seized with the tongue forceps, or dragged forward by means of a silk thread passed through it. During and after the operation the profuse bleeding interferes with respiration. Loose blood-clots fill the pharynx and are sometimes inspired, or cover the epiglottis and larynx. This complication is prevented by operation with the head hanging over the table (see Fig. 23) and by carefully cleansing the mouth.

I have always proceeded with my operations until fairly certain that blood has entered the larynx and respiration is impeded. Then I quickly draw the patient's head over the end of the table and by rapid finger strokes upon the trachea and then the larynx, which is quite compressible in children, force the clots again to the mouth. Of course, this *larynx stripping* must be done *from* the sternum *toward* the mouth, and not the reverse. It is a valuable procedure. Food articles are expelled in the same way (Fig. 32).

Except for these particulars, the general rules for ether and chloroform anesthesia apply to nose and throat operations.

The operations must not be commenced in nose and throat work until the patient is profoundly anesthetized, the conjunctival sensitiveness entirely abolished,—for the profuse bleeding both from nose and throat operations often interferes with the further inhalation of ether and chloroform,—and the patient may become conscious before the operation is completed.

Position and Preparation of Instruments and Apparatus in Operations.

Illumination.—For operations where cocaine is used, the patient sits erect in a chair, the nurse steadies the head

with the hand placed at the occiput, and the operator sits in front of the patient with both the patient's knees between his. The light, best from a condenser, should burn 8 inches

Fig. 23.—Position of Patient with Head Hanging over End of Table.

from the patient's shoulder, on a level with his ear. In complete narcosis, the position upon the back on the operating table is preferable. In adenoid operations, the head should be lower than the body (see Fig. 23).

In ether or chloroform narcosis reflected light for the head-mirror is obtained best from an electric bulb either as a headlight or held by the nurse 8 inches away from the patient's head, on a level with the top of the ear. There is a certain danger of fire from using gaslight near the ether cone, but I have found it quite safe at a distance of 1 foot from the ether cone if a closed inhaler is used. With chloroform there is no danger from flame.

The sterilization of instruments differs in no manner from the ordinary surgical procedure. Heat or compressed steam are the best methods, although formaldehyde gas is much used. The simplest sterilization is boiling for fifteen minutes in a vessel which has previously been wiped out with a bichloride solution, 1 to 1000. The boiling water should contain a quantity of sodium carbonate (ʒj-Oij). A simple and effective way to sterilize instruments that have been soiled is, as the operator uses them, to smear the surface with albolene and hold it for a moment over the chimney of the Argand condenser used for illumination. The albolene liquefies and then evaporates at such a low temperature that the instruments are quickly sterilized without injury to the temper of the cutting edge. Instruments should be used dry, and not submerged in trays of antiseptic solutions.

Towels, sheets, and gauze used in the operation may be boiled and dried, or, better still, sterilized by compressed steam. (See pages 218-220.)

Vessels, trays, or dishes of any kind should be cleaned with soap and hot water, washed in boiling water, and dried. All vessels should be covered with a bichloride towel.

Rubber sheets, rubber splints, articles of cork, and other material injured by boiling should be washed with soap and water and afterward immersed in a formaldehyde

solution, 1 to 100. Such articles may also be sterilized by dry heat.

The nurse should carefully sterilize her hands once, afterward dipping them freely in a bichloride solution, 1 to 1000. She must remember to keep the hands sterile, for one moment she assists at the operation and the next may be required to handle some article, lamp, etc., which has not been rendered aseptic. A towel wet with a bichloride solution, 1 to 5000, must be the constant companion of the nurse, thrown over her arms when she handles articles sterilized and used to cover any article which is not sterile when it is to be removed. In this way the nurse's hands never come in contact with germ-laden articles, but only touch the sterilized and wet towel placed about the unclean article.

THE STERILIZATION OF THE HANDS OF THE NURSE is a matter of extreme importance, and is equally important with clean instruments and an aseptic surgeon. There are two satisfactory methods of cleaning the hands:—

First.—The chloride of lime method, advocated by Dr. R. Wier, consists of scrubbing the hands with a clean brush, water and green soap, carefully cleansing around the finger-nails with a wooden toothpick soaked in an antiseptic solution. After this, a paste is made in the palm of one hand with a little water, some small crystals of carbonate of soda (washing soda), and an equal quantity of chloride of lime (bleaching powder). This paste evolves chlorine gas, an efficient antiseptic, while the alkali removes all trace of fat and the dead epithelium. Carefully wash the hands with this paste and afterward in sterilized water. Cultures made from hands cleansed by this method have never shown any germ growth.

Second.—Permanganate of potash and oxalic acid method: In this method the hands are carefully scrubbed with water and green soap and the nails prepared as in the preceding method. The hands are then immersed in a solution of permanganate of potash—strength, 1 to 1000—for two minutes (sometimes a saturated watery solution of permanganate is used), and afterward rinsed in a solution of oxalic acid until the hands are perfectly white. This also renders the hands absolutely sterile.

Sterilization of Rubber Gloves.—Nowadays it is customary for both doctors and the nurse who assists in the operation to wear rubber gloves. The sterilization of the gloves is a matter of the greatest importance. There are three methods which may be used.

First Method.—The gloves whether old or new are thoroughly scrubbed with green soap, hot water, and a sterile hand brush, they are turned inside out and scrubbed also. Then they are rinsed in water and allowed to dry both inside and outside by turning. The gloves are now tested for holes by blowing them full of air and noting that there is no escape of air from the inflated glove. They are now assorted as to size and powdered with talcum inside and outside. Then they are again tested for holes by inflation and put in cotton cloth cases or glove holders. They are now packed with their cases in a metal drum the cover of which is unlatched and the vents opened. The drum containing the gloves and cases is now put in the steam sterilizer where they are exposed to live steam under 15 pounds pressure for twenty minutes. The vent of the sterilizer is now opened, the sterilizer and contents allowed to dry. Then the drum containing the gloves is closed and removed.

Second Method.—The gloves both old and new are scrubbed with green soap, water, and a hand brush (both inside and outside are cleaned), then they are rinsed in clean water and are now transferred to another clean water in which they are boiled for ten minutes. A table is now covered with a sterile sheet on which are placed sterile glove containers of cotton cloth, also sterile talcum powder and a sterile towel. The gloves are transferred from the boiling water by means of a pair of sterile forceps to the table.

The nurse covers them with a sterile towel. The nurse now sterilizes her hands after one of the methods mentioned on page 267, and places the dried gloves in the cotton containers after the gloves have been powdered inside and outside with talcum.

Third Method.—Emergency method. After the gloves have been tested by inflation to see that there are no pinholes, they are scrubbed inside and outside with soap and water, rinsed in clean water and boiled for ten minutes in plain water. They are taken from the sterilizer with sterile forceps, put upon a table covered with a sterile sheet and used at once.

In a hurry—a real emergency, they may be tested for holes, sterilized by boiling for ten minutes and used at once.

Preparation of the Patient.

Besides looking after the operating room and the sterilization, the nurse is expected to prepare the patient for operation. Some rhinologists claim that the nose is itself destructive to germs because lymph exuding upon the free surface of the nasal mucous membrane is antiseptic. I do not doubt this, but conditions are altered whenever we produce a wound of the nasal tissues, for here the lymph

does not act, and a bacteria-laden nose will infect a fresh wound very quickly. The nose cannot remain sterile for a long time, for it is liable to contamination from inhaled microbes, as well as infection from the postpharynx and from septic matter in the many folds of the nasal membrane which it is impossible to reach with cleansing methods. But much may be done to have the nose and throat *nearly free* from germs or anything that might act as a culture medium after operation.

In operations upon the nose the nurse should first prepare the patient by cutting away with scissors the short hairs growing inside the nasal entrances. The nose is then washed either by a spray or an ear syringe with a mixture of peroxide of hydrogen and water, strength 1 to 4 or 1 to 10. After several injections, using perhaps 2 ounces of the mixture, the patient should receive a nasal douche, and, after the nose is dried by forced expirations or gentle blowing, a piece of cotton should be introduced into the entrance and removed by the surgeon at the time of operating. It is not necessary to shave the upper lip of a patient unless some operation is to be performed which involves cutting this region. A mustache should be carefully washed with a bichloride solution, 1 to 1000.

Tincture of iodine (one-half strength of 3½ per cent.), may be painted over the face, also inside the nostril and over the field of operation. It is then removed by alcohol and leaves a sterile field. It is also an effective method of sterilization of mustache. For the nasal mucous membrane iodine should not be used. For the interior disinfection argyrol 20 per cent. is efficacious.

THE NASAL DOUCHE must be used exactly after the manner which will now be described, or else fluid will remain in the nose or will be forced through the Eustachian

tubes into the middle ear, where it is apt to cause middle ear disease; or fluid may be forced into the antrum of Highmore or the frontal sinus, where it may set up a catarrhal

Fig. 24.—Method of Using a Nasal Douche. (Note position of the head and height of douche bag.)

inflammation. The douche is given with a fountain bag fitted with the nasal tip (see Fig. 24) filled with water, which should be hot—from 108° to 112° F. Water at 110° in the bag will flow from the nozzle into the nose at

107°, and after flowing through both nostrils emerges from the opposite side at 105°. Water at 110° is warm to the nose, at 114° to 116° is hot, and at 120° is hemostatic. To each quart of water, 1 drachm (teaspoonful) of salt should be added to render it non-irritating. Antiseptics are added in such strengths as will not irritate. Practical experience has shown that in the nose and throat tissues antiseptics must be used *well diluted.* The ordinary drugs may be used in the following strengths in douches:—

Sodium chloride	1: 1,000	to 1: 250
Sodium bicarbonate	1: 1,000	to 1: 500
Borax (sodium borate)	1: 1,000	to 1: 500
Boracic acid	1: 1,000	to 1: 500
Sodium salicylate	1: 1,500	to 1:1,000
Potassium permanganate	1: 5,000	
Zinc permanganate	1: 5,000	
Zinc chloride	1: 10,000	
Mercury bichloride	1:100,000	
Formaldehyde (40 per cent. solution)	1:100,000	

After the douche has been prepared it is held 6 inches above the patient's head, the water is allowed to run out at the nozzle until warm, and then the nozzle is put into the patient's nose on the highest or uppermost side. The patient should hold the head well bent upon the shoulders, over a basin, and all respiration must be accomplished *through the open mouth.*

The head must be bent so that one side of the nose is lower than the other side (see Fig. 25). The water will flow gently through one side into the postpharynx. In a second afterward it returns through the other nostril and flows into the basin.

After one side is thoroughly irrigated the head is turned so that the formerly lower side becomes uppermost. The water now enters this side and flows out the other. In

this way the nose is completely cleared of all dust, mucus, and pus. In following this method no solution will enter the Eustachian tube or the nasal sinuses. The patient is

Fig. 25.—Nasal Douche Given with a Bulb. (Note position of patient's head.)

now allowed to blow the nose gently several times till it is entirely cleared, and then one pledget of clean cotton is placed at the entrance of each nostril to prevent further contamination until the anesthetic is administered.

The mouth and pharynx must next be cleansed. A careful disinfection of the mouth is important in some operations, particularly those upon the tongue, lip, or soft or hard palate. The best solutions to use for the purpose are boracic acid, peroxide of hydrogen, permanganate of potash, or formaldehyde. The teeth must be cleansed by scrubbing with a toothbrush wet with the solutions, and each crevice between the teeth and gums must be washed; the mouth

Fig. 26.—Applicators Wound with Cotton. The middle one is wound correctly. The right hand one incorrectly, for the end of the applicator projects beyond the cotton. The one at the left is too bulky at the end.

must be cleansed by frequent garglings, and the surfaces between the lips and gums as well as those between the tongue and teeth carefully cleansed with cotton pledgets dipped in the chosen antiseptic solution. The soft palate, uvula, tonsils, and posterior pharyngeal wall must be scrubbed gently with cotton soaked in antiseptic solution and wound on applicators.

There is a right and a wrong way to wind applicators with cotton, which may be spoken of in this connection.

The end of the applicator must be well surrounded by loose cotton and must never project so as to injure the delicate tissues of the nose and throat. The free end must be loose, the other end wound firmly upon the applicator as it is

Fig. 27.—Method of Making a Cap from a Towel.

turned between the fingers. The free end of the cotton will then form a pad which for nose work should be rather large and very soft, as shown in Fig. 26.

A rubber cap may be placed upon the patient's head to cover the hair when everything is ready for the operation.

If a rubber cap is not obtainable, a sterilized towel well pinned will answer nicely. This serves a double use: prevents infection of the surgeon's hands, and protects the hair from blood, which, when clotted among the hairs, especially with women, is difficult to remove (Fig. 27).

THE DIET BEFORE ETHER OR CHLOROFORM OPERATIONS.

Patients should have no solid food for twelve hours before the operation. Some liquid nourishment, best in the form of bouillon, beef-tea, beef-juice, tea, or coffee, may be given six hours before the operation. Not even a glass of water should be allowed for the six hours preceding etherization. The bowels should be evacuated by enema or a laxative the evening before the operation.

CHAPTER III.

CARE OF PATIENT DURING AND AFTER OPERATION.

Hemorrhage—Vomiting of Blood—Headache and Stupor—Sepsis. Operations Requiring Special Care: Adenoid Operation—Cleft Palate Operation—Tracheotomy—Fissure of Larynx, etc.

Care of the Patient During the Operation.

There are duties which are entirely the nurse's during operation, and preparations must be previously made to meet them. The nurse is expected to attend closely to the number of pledgets of cotton used during the operation, either on applicators or on forceps, to count these pledgets and see that all are removed by the surgeon, who may forget this trifle in the interest excited by the more important part of the operation. A cotton pledget left in the nose, if tucked up behind a turbinated bone, soon ceases to be a trifle, for it acts as a foreign body, becomes septic, and in turn causes sepsis, hemorrhage, or purulent discharge.

The nurse must also keep her mental eye upon the small sponges used to cleanse blood from the pharynx, and see that none remain in the mouth. A bottle containing a 1 per cent. solution of formaldehyde should be used to hold the tissues removed by operation, and the nurse should preserve these at once in this solution. They are then ready for the surgeon's study or the pathologist's knife.

In adenoid operations the nurse must watch the mouth-gag, observe that it is not shaken from its position on the teeth, and, if reintroduced during the operation, that the lip border does not become entangled in the gag.

In tonsillotomy the cut tonsil must be removed, and if lost must be searched for at once in the mouth of the patient; else it may enter the larynx and obstruct the breathing.

Blood or mucus flowing over the conjunctival surface of the eyeball will cause an acute conjunctivitis; and one of the duties of the nurse is to keep this blood and mucus out of the eyes by carefully cleansing the blood from the face or by holding a towel over the eyes during the bleeding. Pledgets of moist cotton are sometimes placed over the eyes and held by the towel cap placed about the head.

If blood or mucus is inspired into the larynx or trachea during an operation, it may cause strangulation or afterward an acute bronchitis or broncho-pneumonia. A part of the nurse's duty is to prevent this by handling sponges quickly, by holding the head of the patient lower than the body, or, if the blood or mucus has entered the larynx and the patient exhibits cyanosis, the nurse must "strip" the larynx (Fig. 32, page 327). A tracheotomy set must always be ready for possible use in this emergency.

Care of Patient After Operation.

Very important duties, indeed, are those of the nurse after an operation has been performed. A good nurse must now be prepared to meet emergencies and to treat them understandingly, else valuable time may be lost and the patient becomes much devitalized before the surgeon can be summoned. In operations generally, but especially in nose and throat work, a physician other than the operator, called in for any emergency, may work with doubt and hesitancy, because he is not wholly familiar with the conditions in the case before him. Especially may this be true in hemorrhage or after septum operations. The nurse must recognize and

control the complications which are apt to arise after operation, viz.: hemorrhage, reaction, disturbance of parts, vomiting of blood, headache, stupor, and sepsis, watch the temperature and pulse, and administer the proper diet.

Hemorrhage.

Moderate bleeding from the nostrils may occur for hours without any danger of exsanguination. If the bleeding is more active, running out of the nostril in a continuous stream, immediate measures must be taken to check it. A steady stream of blood is generally present when some of the venous sinuses have not filled with a clot or from a septal arterial branch having been wounded. Sometimes even the simplest measures will check an alarming hemorrhage. The popular belief seems to be that all nose-bleeds are of considerable seriousness, and patients are apt to become very anxious if the bleeding continues. Bleeding through the nose is, of course, easily recognized, but when patients are lying upon the back, bleeding, even though it be very active, is sometimes overlooked because the blood flows from or into the pharynx and is swallowed. The nurse must inspect the pharynx of patients who have been operated upon. If hemorrhage occurs the blood may be generally seen flowing quite actively from the operated side. If the patient is still unconscious from ether and hemorrhage is feared or suspected, the case should be *rolled upon the side or abdomen and the head placed lower than the shoulders.* Immediately, if there is any hemorrhage, blood will flow from the mouth and nose. If this precaution is neglected in unconscious patients, an active hemorrhage may be present, and all the blood swallowed, then the first evidences will be syncope, or the loss of blood may be so great that patients suddenly become very pale and imme-

diately after vomit alarming quantities of blood. They may even become so exsanguinated that transfusion is necessary.

A nasal hemorrhage, even when severe, may very frequently be checked by making pressure inward against the septum with the ball of the thumb resting flat upon the wing of the nose with the patient's head well bent forward. If the pressure is steady and for a considerable period (from five to ten minutes) very severe bleeding will be controlled. At first the blood will flow around the septum and out through the opposite nostril. Gradually a clot will form and the bleeding will cease. Sometimes the blood will clot in both nostrils and will then flow into the pharynx and out of the mouth. If the pressure is continued the bleeding ceases soon after this has occurred. An icebag may be applied to the nape of the neck to stimulate the contraction of the nasal vessels It is a valuable supplement.

If, after ten minutes, the bleeding has not ceased or in a shorter time if the bleeding is active, other methods must be used. These are: (1) the cotton plug; (2) hot-water douche; (3) peroxide of hydrogen; (4) extract of suprarenal glands or adrenaline; (5) complete plugging; (6) posterior nasal tampon.

If these are used in the order named, some one of them will completely control bleeding.

The cotton plug is made of absorbent cotton wound loosely upon a probe or applicator, about 2½ inches long in a cylindrical form. This plug is used dry or saturated with peroxide of hydrogen or a solution of aceto-tartrate of aluminum, and is pushed directly backward into the nostril its full length. The metal applicator is now withdrawn, leaving the plug in place, its end slightly protruding from the nose.

If the hemorrhage is not checked by these procedures the plug must be withdrawn and styptic measures used. There are only four styptics safe to use in the nose, namely: peroxide of hydrogen, hot water (125°), solution of aceto-tartrate of aluminum (1 to 8), and watery extract of the suprarenal glands or an alkaloid solution of the suprarenal glands. The hot-water douche (125°) is used as described in Chapter II, pages 270-274, of this part, the peroxide of hydrogen with an ordinary syringe or spray, the suprarenal extract in a spray, and the aceto-tartrate of aluminum is applied by spray or on a cotton plug. All other styptics are corrosive, and should never be used. Iron especially is to be avoided, for it, with other stronger styptics, is caustic, and leaves the mucous membrane in a very irritated, congested, and even ulcerated condition. I wish to except here certain caustics which may be used by the physician to control hemorrhage when applied to the pleeding point with great care.

The Nasal Plug.—To completely plug the nostril, cotton pledgets on applicators may be used and several small plugs introduced in different directions into the bleeding side. The first plugs should be introduced well back, the next ones pushed high up, then several pledgets may be placed in front of these until the nostril is completely filled. A careful count must be made of the number of plugs introduced to insure removal of the entire number later, for any left behind will cause serious annoyance from discharge and sepsis. It is not always easy to find these pledgets tucked away in the folds of the mucosa and covered with blood and mucus.

An approved method is to use one long strip of antiseptic gauze about ¾ inch wide, introducing it well backward for 2½ inches low down on the nasal floor, and then

pack above and in front of this until the nostril is completely filled. The end sticking from the nose is easily found and no difficulty arises from any pieces being left, for it all comes away in one strip. The loose meshes of the gauze cause a more rapid entanglement and clotting of the blood. Medicaments may be used on the gauze as on the cotton.

THE POSTNASAL TAMPON is the last resort, and will surely stop the hemorrhage. A nurse will rarely use it, but should have every part of the plug ready for the surgeon's use. She should understand what is to be accomplished, for valuable aid may be rendered the surgeon. The postnasal plug is applied by passing a string, rubber tube, or English catheter through the bleeding side of the nose, pulling the string, tube, or catheter through the mouth; to this another doubled string is tied holding the plug; by drawing this double string through the nose the plug follows to the uvula and is easily pulled into the postpharynx behind the uvula aided by manipulation with the fingers. The nose is then packed with gauze and at the anterior nasal orifice a second plug is tied with the projecting double string, and effectively holds both plugs—the anterior and posterior—in firm position. If a catheter is used it should not be too flexible. A heavy string or tape is passed looped through the entire length of the catheter. The loop should be waxed to prevent softening with saliva and subsequent difficulty of manipulation. From the eyelet end, the loop should project 3 inches; from the open end, the loop should project the length of the catheter. The plug should be firmly rolled and large enough to fill the *whole* postpharynx. In an adult male, 1½ inches by 1 inch in diameter is the usual size. A double string or tape is tied around the middle of the plug. The strings should be 8 inches long; they are tied on the tape

Fig. 28.—Postnasal Plug.

Left hand figure shows the plug and double string. Right hand figure shows the catheter with string running through it.

Fig. 29.—Postnasal Plug.

Section of a head showing first step of plugging, the catheter and string passed through the nose to the pharynx

Fig. 30.—Postnasal Plug.

The catheter w'thdrawn and the string pulled through mouth and tied to the large cotton plug.

Fig. 31.—Postnasal Plug.

The plug is now in place, having been pulled there by the string aided by pushing it with the fingers in the mouth.

or string coming through the nose, pharynx, and mouth, the plug being pulled into place by traction. Usually a third string is used on the plug for purposes of easy removal; but, as this string is a continual source of annoyance to the patient, it is better left off and the plug removed when necessary with a pair of adenoid forceps.

Everything being in readiness, the patient is allowed to irrigate the nose and throat with Dobell's solution or any antiseptic wash. While this temporarily increases the hemorrhage, it is of great use in cleaning the parts, and thereby allows the retention of the plugs a longer time without sepsis. With a good light reflected into the patient's nares and pharynx, the catheter, oiled and threaded as above described, is introduced through the bleeding side into the pharynx, where the stiffened wax loop is easily drawn through the mouth with forceps and held firmly against the teeth while the catheter is withdrawn, leaving the waxed loop running through nose, throat, and mouth. To the loop in the mouth both the plug strings are firmly tied and the plug is pulled in place in the postpharynx, its course being over the tongue and behind the uvula. It is guided into place by the index finger of the left hand. As it reaches the postpharynx the tendency of the plug is to fold or else enter endwise. This must be controlled or the pharynx will not be completely plugged. The plug should enter the pharynx crosswise or horizontally, and must be firmly pulled forward toward the nose *so as to fill completely the posterior nasal opening and prevent further exit of blood.* The pulling must be continued until the plug is well jammed into the posterior nares and naso-pharynx and is out of the way of the movement of the uvula. The two strings coming through the nose from the plug are now separated and gauze is packed between them. When the

naris is moderately filled another plug is introduced into the anterior naris, completely filling it, and the two strings are tied tightly over the anterior plug. As the strings are tightened, the anterior plug will enter the nose and a second knot may be tied over the first one. The nose is now thoroughly plugged. The hemorrhage will cease at once. Failure to check bleeding generally results from a plug, posterior or anterior, which is too small, or else from neglect to pack the nasal cavity with gauze. The plugs very soon become wet and slimy and slip easily if they are not firmly pulled into place and securely tied. If the plugs are satisfactory they need not be removed for forty-eight hours or longer, the indication for their removal being sepsis or pain in the ear. If hemorrhage continues, the plugs must be removed and new ones introduced of larger size.

The removal of the plug is accomplished by cutting the thread over the anterior plug, removing the anterior plug, and allowing the gauze to remain undisturbed. Adenoid forceps gently introduced behind the uvula will grasp and remove the posterior plug easily, and obviate the danger that the plug may be swallowed. The gauze may be left in place for another twenty-four hours, and great care should be exercised when it is removed. It must be thoroughly loosened by a douche of peroxide of hydrogen so that the recently bleeding point may not be freshly torn open and hemorrhage recur.

The different stages are shown in the illustrations on page 283.

Reaction After Plugging the Nose.—Under the term reaction is understood those constitutional symptoms which appear within the first twenty-four hours following an operation. They are generally inflammatory or con-

gestive in character and vary somewhat in severity in individual patients. In some patients reaction is always marked; in others no symptoms follow even a severe wounding of the mucous membrane. It may be stated that, as a rule, reaction symptoms are greater from cautery or drill operations than from surgical incision. In very sensitive people reaction may appear a few hours after operation, or in less sensitive persons it may be delayed or altogether absent. The symptoms are those of a beginning "cold": headache, chilliness or even a chill, febrile movement, exhaustion, and prostration. Usually, there are marked muscular pains in the legs and arms and local nasal symptoms of swelling, obstructions, heat, and discharge. Under appropriate treatment the reaction symptoms are controlled and subsequent sepsis often prevented.

Treatment.—Removal of plugs is indicated, followed by a careful cleansing of the parts with peroxide of hydrogen solution (1 to 20), followed by a douche of Dobell's solution or of normal saline solution. A soothing gargle or nasal salve may be prescribed by the physician. In pharyngeal cases an iced gargle of alcohol and water, 1 to 10, or witch-hazel gargle, also iced, gives great relief. The headache, fever, and muscular pains are relieved by aconite and belladonna in small and frequently repeated doses or by the use of the coal-tar preparations: phenacetin, acetanilide, and antipyrin. A tablet of salol and phenacetin (āā gr. ij), used half-hourly, will give speedy relief and will in many cases prevent the development of septic symptoms if used immediately after the operation and before reaction appears.

The same reaction symptoms may occur later, when they are probably septic, but there seems no reason to assign these early symptoms appearing the first day after

operations to a septic condition. If reaction symptoms are pronounced and do not yield readily to the above treatment, the patient should at once be placed in bed. In a few cases meningitis has been a complication of nasal operations, and this must always be borne in mind. Cases with much headache should have ice applied to the forehead and ice cloths laid over the nose and face. These should be renewed often enough to keep the parts refrigerated.

Serum Treatment for Hemorrhage.—Horse serum, 20 c.c. in adults, 5 to 10 c.c. in children, is used by hypodermic injection into the muscle over the scapular region as a method to increase the coagulability of the blood. It is a very useful procedure. In very serious cases human serum from a pregnant woman has been known to be an efficient coagulating remedy when other plans failed. Only the serum from glander-free horses or from syphilis-free women should be employed.

Calcium lactate, gr. v, each four hours, by mouth, is used also as an adjuvant to the serum treatment.

DISTURBANCE OF PARTS.

Careful watching is required in plastic work to prevent a return of the deformity for which the operation was performed. Nasal splints used in septum cases should be retained without protrusion. In case the splint fits improperly and tends to be forced from the nose, it can be held, until the physician adjusts it, by a piece of adhesive plaster passed over the protruding end and fastened on each side of the nose. After a week, the only danger of septum deformity returning exists from the accidental rolling upon the nose while in bed. Care will control this accident. In operations affecting the nasal bones, after their replacement the bandages must be given the closest attention and any

deformity must be immediately corrected as soon as the slightest displacement is noticed.

VOMITING OF BLOOD.

This is a usual occurrence after any operation upon the nose and throat requiring an anesthetic. In septum cases or in the removal of adenoids or tonsils the bleeding is generally profuse during the operation and large quantities of blood are swallowed by the patient only to be expelled by vomiting after consciousness returns. The vomiting of this blood is apt to be alarming to the untrained attendant and even to the nurse, especially if the case has shown any tendency toward hemorrhage during or after the operation. This blood is expelled from the stomach rather suddenly by projectile vomiting, and is preceded by a period of marked cardiac depression. The face becomes pale, the prostration extreme, and the heart-action and pulse scarcely perceptible; and, while these symptoms are marked and simulate exactly the extreme collapse caused by bleeding, the vomiting of the swallowed blood suddenly occurs to add to the anxiety of the nurse. The true state of affairs is soon revealed, for after the vomiting of this blood the condition of the patient improves and anxiety gives way to satisfaction. Sometimes the entire quantity of blood in the stomach is not expelled at one vomiting attack, in which case the period of collapse is prolonged and is succeeded by a second vomiting attack, in which the entire stomach contents are expelled, to be immediately followed by improvement in the general condition. When this collapse is prolonged it is important to know whether or not the hemorrhage has ceased entirely. If the hemorrhage is continuous, it may be recognized in unconscious and anesthetized patients by noting any attempts to swallow.

If such are present, the probabilities are that the hemorrhage continues, and the pharynx must be inspected at once. If the blood is not entirely vomited it passes on to the intestines, and several black, bloody stools will be noticed the following day. Sometimes a part of the blood is vomited and the remainder passed per rectum as bloody, diarrheal stools.

HEADACHE, STUPOR, AND SEPSIS.

Headache after operations is due to reaction, fever, inflammation of local parts, and sepsis, or to the pressure from plugs, splints, or foreign bodies. If possible, the cause should be removed and the pain will immediately be relieved. When it is not possible to remove the cause, the pain may be relieved by applications of ice cloths over the nose or applied to the frontal region. Internally, the administration of acetanilide, phenacetin, caffeine, camphor, or bromide, either alone or combined, results in relief.

If headache persists and becomes more severe and constant, particularly if the eyes become sensitive to light, one must bear in mind the possibilities of meningitis developing, and immediate measures should be introduced to control this serious complication. The combination of headache, photophobia, and some degree of stupor or mental apathy indicates quite clearly the way the case is drifting.

NASAL SEPSIS.—This is much more common than is generally supposed. Sepsis occurring after operations may be of a severe type or of rather a mild one. It is often known as "taking cold," and patients who are supposed to have taken cold and developed tonsillitis after operations frequently have not taken cold at all, but are suffering from septic absorption, expressing itself in inflammation, follicular tonsillitis, or quinsy sore throat.

In more serious forms of sepsis one finds pus in the region of the operation, or sloughing, or the extension of inflammation into the various accessory cavities of the nose.

Fortunately these severe cases are extremely rare. When a patient has become septic the symptoms are those of local inflammation of the nose, headache, pains extending into the muscles of the shoulders and down the back, chilly sensations which rarely develop into a well-defined chill and a feverish condition; sore throat then develops, pain on swallowing, local heat and tenderness in the regions of the operation, and sometimes slight hemorrhages result from the inflammation.

If the sepsis is mild, the symptoms may subside in the course of twenty-four hours. If, on the other hand, it is more severe, the case will present evidences of complications and will disclose particular symptoms which are dependent upon the regions involved. Nearly all cases will develop tonsillitis or quinsy sore throat.

Treatment of Sepsis.—During the operation vomited matter may enter the nose and throat, especially if the head is hung over the table at the time of operation, and, unless cleaned away after the operation, may act as a *nidus* for the beginning of sepsis. As a rule, then, it is well to wash over the field of operation—after the operation is completed—either with a plain saline solution or a weak solution of peroxide of hydrogen, 1 to 40. In minor cases no particular attention need be paid to the throat or to the nasal cavities, except possibly, in nasal cases, the placing of a plug of cotton in each nostril, allowing it to remain for the first twenty-four hours after the operation.

There are certain general rules which may be followed regarding the cleansing of the nose after an operation, for the prevention of sepsis, which may be used commonly for

all operations; but in a few cases it is necessary to make particular mention of methods to be employed for special operations.

It is a good rule not to disturb the parts operated on for the first twenty-four hours, for during this time nature is pouring out an exudate which is purely aseptic and will serve fully to protect the wounded tissues for that length of time. If no bacteria have been conveyed into the substance of the tissue, then after the end of twenty-four hours there is no possible danger of sepsis, unless such material be carried to it subsequently. As a rule, then, a sterile irrigation may be given at the end of twenty-four hours, which will serve to remove *débris,* mucus, and blood-clots, together with any bacteria which may have entered the nose since the time of operation. An argyrol spray (15 per cent.), used every three hours, is a satisfactory routine treatment after forty-eight hours.

In operations upon the mouth, except where specially mentioned below, it is well, perhaps, to irrigate the mouth oftener than has been thought desirable for the nose, because it is much more difficult to clean and easily becomes infected. It may be best to cleanse the mouth by means of irrigation rather than gargling or mouth-washing, because these may be the means of carrying infection. The head should be tipped well forward, the tongue protruded, and a coarse irrigating nozzle placed in the mouth and directed against the lateral folds of tissue and the posterior pharynx. The same strength of solutions may be used in the mouth as in the nose.

Irrigation of the frontal sinus should always be given by the attending physician. After turbinate operations the douche should be used to irrigate the nose two or three times a day. In case of an operation upon the antrum

of Highmore, if the sinus is not padded with gauze, it is necessary that it should be irrigated at first every four hours and after the second day three times daily. I have found a solution of chloride of zinc, about 1 to 10,000, very advantageous in irrigating the antrum of Highmore.

If the operation for deflection of the nasal septum has been done, and packing has been introduced into the nose, unless symptoms of sepsis are clearly present, the packing should not be removed for forty-eight hours. In case sepsis appears, the packing must be removed from the nose, and it should be thoroughly cocainized and irrigated. When perfectly cleaned the packing may be carefully reintroduced. It may not be necessary again to remove the packing for twenty-four hours.

After adenoid operations the danger from sepsis is very slight; because naturally the parts are well adapted for self-drainage. Cases of sepsis and one or two cases of tubercular infection have been reported, however, showing the necessity of aseptic care during an operation and aseptic treatment afterward.

The best way to cleanse the postpharynx after the removal of the adenoids is by means of a soft rubber catheter, the size of which depends on the size of the nostril, one being chosen which, when well oiled, will easily pass into the postpharynx from the nasal orifice. This catheter is attached to a syringe or fountain bag holding a quantity of sterile irrigating fluid, and the water is allowed to flow gently through the catheter directly into the postpharynx, while the head is bent forward and the patient breathes through the mouth. In this way the postpharynx can easily be cleansed of any discharge without danger of the fluid entering the Eustachian tubes or larynx. The fluid returns through the opposite side of the nose and is discharged into

the basin held under the patient's chin. This is a very satisfactory method of irrigation of the postpharynx, and may be done two or three times a day when there are no symptoms of sepsis. In the event of sepsis occurring, irrigation may be employed every three hours. In cases of hemorrhage the douche is contra-indicated, as, in fact, is all disturbance of the parts, until hemorrhage has ceased.

Sepsis after adenoid operations is apt to spread into the pharynx or to invade the cervical lymphatic glands. These glands may suppurate. Such an extreme condition is rare. In most cases the limit of sepsis will be an enlargement and tenderness of the neck glands. Local applications of ice or heat, or soothing applications of chloroform or belladonna liniment, applied externally to the neck relieve the condition rather promptly; the glandular swelling rapidly subsides after septic absorption has ceased.

After tonsil operations sepsis is of extremely frequent occurrence. It is impossible to render the mouth aseptic, and infection of the pharynx almost invariably occurs after tonsil operation. This expresses itself in pain on swallowing, tenderness in the glands of the neck, chilly sensations or rigors, followed by fever and other classical symptoms of sepsis. Much may be done by the nurse to prevent a development of these troublesome difficulties by carefully cleansing the mouth with the well-known antiseptic solutions or anything recommended by the attending physician, and by the irrigation of the pharynx from a fountain syringe about every third hour. After twenty-four hours the danger of sepsis is practically passed, and, unless the fibrous exudate which covers over the tonsil region is removed by instrumental interference, sepsis is not apt to occur.

Occasionally one sees an infiltration of the anterior or

posterior pillars of the fauces. Sometimes this inflammation extends downward, attacking the folds of the pharynx and sometimes the base of the tongue. Intense pain on swallowing is apt to result from this inflammation, which may be relieved somewhat by cold applications externally or by sucking pieces of cracked ice, or by the application of any anesthetic or anodyne solution recommended by the physician. Such solutions generally contain certain quantities of cocaine, eucaine, orthoform, or iodoform, all of which are very palliative to this inflamed tissue. The use of iodoform or orthoform is particularly useful; the only objection to iodoform is its intensely disagreeable odor. Orthoform has almost entirely superseded the use of iodoform, and can be recommended to be used in dry form or in emulsion upon these inflamed areas.

After operations for cleft palate a safe adjunct to the treatment is a careful cleansing of the mouth by a sterile solution used about every three hours. The nose should also be irrigated after operation. The method of doing it is most important. It must be accomplished in such a way that the patient will not gag, because the movement of gagging may tear away the stitches and defeat the purpose of the operation. All irrigation must be accomplished by the patient lying on his face, or rather on his chest, the edge of his face being over the edge of the bed. While in this position the mouth may be irrigated, using a catheter and a stream of water under low pressure or a medicine dropper; the nose may be irrigated in the ordinary way.

CHAPTER IV.

DIET AFTER OPERATION.

Diet in Nose and Throat Cases, General Considerations—After Laryngotomy and Laryngectomy—Diet in Staphylorrhaphy Cases—Diet after Adenoid and Tonsil Operations—Diet in Extirpated Epiglottis—Diet in Intubation.

In some cases of surgical operation diet plays an important rôle in the ultimate result, and sometimes the issue between failure and success is determined by the care which the nurse gives to the diet of the patient and the regularity with which nourishment is given.

After surgical operations upon the nose and throat the question of diet is always a very important consideration; and the subject at once divides itself into general considerations, which apply to all cases, and special considerations, after particular operations. As a rule, it may be said, for the first twenty-four hours after a patient has had a nasal operation, or until the danger of septic inflammation is ended, the patient shall be kept more or less on light diet, preferably of a liquid character. Beef-juice, strong soups made of meats, eggs and milk beaten together, and oysters are the best to use. Oysters and chopped meat are valuable. After twenty-four hours patients who are allowed out of bed may be put on regular diet. In the event of unfavorable symptoms developing, particularly fever, it is best that patients remain on liquid or semi-liquid diet administered every three hours in quantities of about 6 to 8 ounces at a time for adults, and for children smaller amounts.

In most nose operations there are no particular dietary instructions to be followed except after operations upon the antrum through the mouth. In such cases diet is best given through a tube, and it should be arranged so that no fluid shall enter through the mouth into the antrum or nasal cavity.

Diet in Staphylorrhaphy (Cleft Palate).

It has been my practice in these cases to feed a patient well preceding an operation, giving him a quantity of highly stimulating food a safe time before the ether is given, and then to starve him for three days afterward, even forbidding him water. In certain cases where hunger has been so keen that the patient has been unable to go longer without food, nutritive enemas have been resorted to. Certain quantities of water mixed with peptonized milk, white of egg, whisky, sometimes a strong meat-broth, etc., have been introduced regularly into the rectum.

I consider the deprivation of food and water—at least the avoidance of its introduction through the mouth—one of the very important elements of success in these cases. After three days patients may take small quantities of liquid nourishment by the mouth with teaspoonful doses of water, and no harm will result to the healing. After three days more the diet may be increased, but remains liquid in character. The incision must be carefully watched and if no harm results the diet may be further increased. Soft bread, oysters or gruel, or other nutrient articles of the same soft consistency may be given to the patient until he is taking fair quantities every three hours. Solid food must not be given until three or four days after all stitches have been removed.

After tonsil or adenoid operations the comfort of

the patient is very much increased by the character of the diet which is given to him. These patients do not require much to eat for the first twenty-four hours, but what is given should be of a liquid character. It has been noticed that patients who have difficulty in deglutition swallow much easier when large mouthfuls are given than when trying to sip small quantities through a tube. It is therefore a good rule that the patient take a large mouthful of liquid nourishment; the pain from swallowing a large mouthful is much less than that from swallowing in sips.

When there is pain after tonsil operations the stumps may be rendered less sensitive by the introduction of ice preceding the nourishment, or the application of cocaine if the pain is extreme. While cocaine may relieve the pain of the sufferer, it destroys the desire for food almost absolutely. A patient is apt to refuse food after cocaine. It is better to use ice only. Small quantities may be held in the mouth until the tonsils are insensitive. Liquid nourishment may also be used quite cold. At once we see that ice cream is an important adjunct in the nutrition of the patient. It consists largely of cream or milk and eggs, digestible and palatable in cold form. It is readily and easily taken by patients, especially by children, when other nourishment is refused. It may be necessary occasionally, in tonsil or laryngeal operations where the pain of deglutition is very severe, to pass a catheter through the mouth into the esophagus in order to feed the patient. This is required only in extreme cases.

After extirpation of the epiglottis patients experience difficulty from food entering the larynx. This is overcome by allowing the tongue to sink well back into the mouth during the act of swallowing, when it becomes an artificial epiglottis, closes over the orifice of the larynx, and forces

food into the esophagus. This method should be practised at first with plain water.

In intubation cases children must be fed while lying on the back, while the head is kept lower than the chest and abdomen. In this way children are able to swallow large quantities of liquid nourishment through a tube.

Feeding after Laryngotomy and Laryngectomy.

I. *Laryngotomy cases* are easier to feed than those cases of laryngectomy where the larynx has been removed. Where the thyroid cartilage has been incised and subsequently sutured, the case should not receive either water or food by mouth for the first twenty-four hours.

The necessary water may be introduced *per rectum* by Murphy drip method, and if necessary a nutritive enema may also be administered. After twenty-four hours the swallowing ability should be tested with a teaspoonful of sterile water, if successfully accomplished without causing spasmodic coughing, *e.g.,* without the water entering the larynx, it may be repeated several times and then at regular two-hour intervals. Broth and boiled milk may now be substituted in quantities of 1 ounce each feeding. The patient should be kept on liquid diet until the wounds have healed, usually for one week.

Usually laryngotomy cases are not difficult to feed. In cases where the epiglottis has been removed, however, the difficulty with swallowing increases and sometimes even the life of the patient is imperiled from continued inability to swallow. The coughing excited by fluids entering the larynx not only discourages the patient from making attempts to swallow but may even tear open the parts which have been sutured and annihilate the results expected. When this threatens to occur one should feed the

patient by passing a soft rubber catheter gently into the esophagus through the mouth. When it has entered at least 12 inches from the teeth, a teaspoonful of sterile water may be poured into the funnel attached to its end and if coughing does not result then nutrition of a liquid nature and water may be introduced in large quantities. Enough to satisfy the patient for twelve hours may be given at one time and the catheter withdrawn. This procedure is repeated twice daily, each time in exactly the same way until the patient is able to swallow.

II. *In laryngectomy cases* the difficulty of feeding is much increased. Usually when the operation is completed the surgeon passes a very long catheter through the nose into the pharynx and then into the esophagus. This tube is as large as will pass through the nose and is now left *in situ,* the end projecting from the nose being fastened with a silk thread to the cheek by means of a piece of adhesive plaster. The patient is then given water and liquid nourishment through this tube with the aid of a syringe or funnel. Much can be said against this method, the secretions of the mouth and pharynx are prevented from entering the esophagus. Thus they frequently enter the larynx, excite coughing attacks, cause the wound to be torn open or to become infected from the secretions. The catheter also blocks from esophageal swelling or from coagulated milk or other *débris;* or lime salts are deposited about the catheter. Such a feeding tube is a source of wound infection which should if possible be avoided.

My own preference is for prolonged rectal feeding until the patient is able to swallow, and to use the esophageal tube only if the nutritive enemata are not retained.

They should contain peptonized milk, ℥vj; sugar of milk, ʒj, and water, ℥ij. They should be introduced warm.

CHAPTER V.

SPECIAL THERAPEUTIC MEASURES.

External Application—Counter-irritants—Splints—Dressings—Douche: Nasal, Laryngeal, Pharyngeal—Postnasal Douche—Application by Spray. Internal Local Application: Solutions—Powders—Inhalations—Gargles—Lozenges—Vaccines.

External Applications.

In nose and throat work it frequently becomes necessary to usc certain external applications, which may be considered under the heads of (1) heat and cold, (2) applications to produce a soothing effect, (3) applications for counter-irritation, and (4) applications for support (splints).

Heat is applied by hot-water bags; by means of a sponge wet in hot water and squeezed out; by means of a bag of hops or salt heated in an oven to the requisite degree of heat; or sometimes a porcelain plate or other household articles are used when their form permit their application to the regions to which heat is to be applied.

The most comfortable form of heat to use about the head and throat is either a hot-water bag or a poultice, which may be made of flaxseed.

Cold is best applied to the nose externally by means of cloths which have been cooled upon a cake of ice. As soon as the cloths are warm a fresh one is applied and the other is replaced upon the ice The ice-cap, a rubber cap filled with small pieces of ice, is often of considerable use in nose work, particularly for the relief of headache. If used on the throat ice is best applied by means of a bladder

or bag, long and narrow, filled with ice wrapped about the throat of the patient.

Sometimes heat and cold are applied *internally* by means of inhalation, but that will be considered under a special head later on.

Soothing applications are applied to the nose and throat generally for the purpose of reducing inflammatory swelling, edema, or cellulitis. The class of remedies of which lead and opium wash is a type is applied directly upon the parts by means of cloths soaked in the solution. Other remedies may be used in the same way, as will be specially indicated by the attending physician.

Counter-irritation is generally applied to the larynx and sometimes to the nose by means of liniments, or plasters, or the application of iodine in solutions of various strengths. The most common form is tincture of iodine. All of these remedies are applied according to the general rules laid down in the ordinary text-books on nursing.

Splints for the support of various parts of the nose or throat are applied in cases of fracture, either accidental or instrumental.

The nurse's duty in regard to the management of splints is to observe very carefully whether the splint has moved from its original position. In case this occurs it becomes the duty of the nurse either to notify the physician at once or, before his arrival, to make an attempt to replace the splint in the position it occupied before it slipped.

The larynx is seldom supported by means of a splint, but sometimes it is necessary to use the splint in fractures of the thyroid cartilage. A plaster bandage is generally used for such cases.

Splints for the nose are used externally and internally. The external splints are generally held in place by strips

of rubber plaster and a bandage, and often serve the very important purpose of holding up the bridge of the nose; particularly when cosmetic operations have been performed on the nasal bridge to alter its shape.

These splints, if removed, must be taken away very carefully, and, if readjusted, must be done always with the idea of making such pressure on the sides of the nose as will hold up the nasal bridge.

The splints which are used inside the nose are placed there generally after a fracture of the septum, either from traumatism or from an operation done to straighten the nasal septum. These splints are generally hollow hard rubber tubes and are retained inside the nose by catching under the free edge of the nasal orifice.

Such splints have a tendency to move forward or backward. They may then be considered ill fitting and others should be substituted. If they show a tendency to protrude and escape from the nostril, they may be removed and smaller ones used, or more conveniently, held in place by means of a narrow strip of rubber plaster placed over the end of the splint, turned upward, and fastened on each side of the nostril.

Dressing after Plastic Operations on the Nose for Nasal Deformity.

The dressing to retain the bones of the nose in proper position both after fracture of the nasal bones and after operations for deformity of the nasal bones as practised in the Post-Graduate Hospital, is a very satisfactory one and is made as follows: The face and hair after the operation are cleaned from blood by gasolene or alcohol, then a strip of adhesive plaster 2 inches wide and 2 feet long is applied at the middle tightly and firmly to the nape of the neck and

each end is drawn tightly forward coming under the lobe of the ear forward to the cheek on each side as far forward as 1 inch from the side of the nose. This piece forms an immovable anchorage for the rest of the plaster which is to hold the nose in position. Two *tightly* rolled gauze pads 1 or 1½ inches long and ½ inch in diameter are placed laterally along the base of each nasal bone, one pad on each side of the nose. While an assistant compresses the pads firmly against the nasal sides a strip of plaster 1 inch wide is attached to the anchor plaster on one side, drawn over the nose and pads and fastened to the anchor plaster on the opposite side. This holds the operated parts firmly under the pressure of the pads and plaster. To prevent any slipping downward of the pads, two and sometimes three pieces of plaster are attached to the pads or the strip of plaster extending over the nose and then to the forehead. This dressing should be renewed each third day until the parts are united.

When transplants of bone are used to relieve "sunken nose" deformity the same dressing is used but much more loosely applied.

Nasal, Pharyngeal, and Laryngeal Douche.

The douche is used for the purpose of removing any foreign material, bacteria, scabs, mucus, or pus from the nose or throat.

The douche may also be used to convey a medicated fluid for the purpose of the treatment of any of the cavities of the respiratory tract; or it may be used for the therapeutic effect of heat or cold.

The nasal douche may also be used after operations as a means of cleansing the parts which have been operated

on, preparing them for the further treatment of the nasal surgeon.

It is possible for some patients to douche the larynx so it may be cleaned for the reception of medicines or for an operation. The method of using the laryngeal douche has already been discussed in a previous chapter.

PHARYNGEAL DOUCHE.

The pharyngeal douche is useful for the purpose of preparing the field of operation, washing away discharge, or for the benefit of direct application of heat and cold. It is particularly useful in quinsy sore throat or other forms of suppurative diseases of the pharynx. It should be used as often as every two hours. The vessel holding the water should be 3 or 4 feet higher than the well-flexed head of the patient. The communicating tube is generally of rubber, and the nozzle is of any convenient form that will throw a stream into the pharynx. This is introduced into the mouth, the tongue is pressed downward by means of a spoon or a tongue depressor, and the liquid is allowed to flow freely into the mouth from one side to the other, then to the palate, and, last, to the pharyngeal regions.

If the pharyngeal mucous membrane is douched in this way it can be cleansed without the patient having swallowed a drop of the liquid.

NASAL DOUCHE.

The nasal douche may be given after two methods: First, a very coarse atomizer may be used which will throw almost a stream of water or very large drops of water which almost form a stream. If such an atomizer is used both nares will be well cleaned. The second is what is generally

known as the "nasal douche," and, while there are different methods, that which will be described here has stood the test of time and is considered safe and devoid of the usual dangers of the nasal douche. It is one that has given entire satisfaction in my work:—

The apparatus to hold the supply of water should have a capacity of about 2 quarts, and is best made in the form of an irrigating glass or the more convenient form of a rubber fountain-bag irrigator. To this reservoir is attached a tube which terminates in a perforated conical-shaped tip used to fill the nostril through which the douche is to be given. This irrigating bag is filled with water, the temperature of which is about 110°. In the water dissolve a suitable antiseptic, together with a certain quantity of bicarbonate of soda or chloride of soda, 1 drachm to the quart. The bag is hung so that its lower level will be at least 4 or 6 inches and not more than 18 inches above the flexed head of the patient. In this way a part of the danger of the water entering the Eustachian tube is overcome. The end of the nozzle is introduced into one side of the nostril while the head is bent over and *the patient is breathing through the mouth.* If the patient will make no attempt to swallow the water when it first flows into the naso-pharynx it will immediately make its appearance from the opposite nostril, having flowed from one nostril into the nasal pharynx, around the nasal septum, and into the other side. If great care is taken not to swallow, or to breathe through the nose, there is not the slightest danger of the liquid entering the Eustachian tube. The douche may then be continued on one side until that side is thoroughly cleansed, when the nozzle may be changed to the opposite side. This side is washed in the same manner as before described, only the flow is in an opposite direc-

tion. *If the patient is careful not to blow the nose while it is filled with water,* but instead will allow the nose to drip, there will be no danger of forcing the liquid into the Eustachian tubes or any of the accessory cavities of the nose.

It is improper to use the douche when it is hung so high that considerable force is obtained by gravitation. This is dangerous to the Eustachian tube, and may even force the water into some of the accessory sinuses of the nose. It is also improper and dangerous for a patient to swallow or make any attempt to breathe through the nose while the water is running from the douche through the nose. An attempt to do this will result either in the water entering one or both of the Eustachian tubes or the larynx, where it will be expelled by violent paroxysms of coughing, which may force the water into the regions where it is both harmful and unnecessary.

It is also improper for the patient to use the nasal douche with the head bent backward, and, in fact, to use any form of irrigation of the nose by means of the Bermingham douche, or to use any stream of water which may flow into the nose while the head is bent backward. By this method the water will surely enter the naso-pharynx and drop into the pharynx, and in the attempts which the patient makes to expel the water from the pharynx it may be forced into the Eustachian tubes.

In *résumé,* then, we may say:—

1. The nasal douche is better used always after an application of a weak solution of cocaine (1 per cent.), which will help shrink the nasal tissues and remove the danger of blocking up the water anywhere within the nasal cavity.

2. Water should be used at a temperature of 110°.

3. It must have a specific gravity which will not irritate the mucous membrane; this is easiest obtained by adding 1 drachm of common salt or the same quantity of borax or bicarbonate of soda to each quart of water used in the douche.

4. We must remember that the position of the patient is important. The head *must not bend backward,* but be flexed so that the chin will nearly touch the chest, and must be held over a basin.

5. The patient must breathe through the mouth during the process of irrigation, and not the slightest attempt made to draw water through the nostrils. The mouth must be wide open during the process of douching.

6. If it becomes necessary for the patient to cleanse the nose by blowing, during the process of irrigation, the flow must be cut off and the nose blown in what may be called the open position,—that is, without hand or handkerchief being applied to the nostril and with both sides of the nostril opened, so that the water may drain through both sides at the same time.

7. The nose must be dried by blowing into the handkerchief only after the excess of water has been allowed to run out, or, what is a better method, by the patient breathing rapidly through the nose six or seven times after water has been drained from the nose.

Postnasal Syringe.

The postnasal syringe is sometimes used to cleanse the nose from behind, and it is claimed for this syringe that, as all of the irrigating holes are only on the front of the tube, there is no danger of water entering the Eustachian tube. The syringe, when filled with the desired solution for

irrigation, is passed into the mouth, behind the uvula and soft palate, and is turned upward behind the uvula so that the point becomes entirely hidden and the entire curve rests behind the soft palate. At the moment this position is attained the piston is forced into the barrel and the liquid, escaping through the end of the syringe, is injected through the nostril and appears at the anterior end of the nose. By this method it is possible to irrigate from behind forward, through both nostrils, with a rather small quantity of irrigating fluid. The head of the patient should be flexed forward upon the chest after the nozzle has reached its position in the posterior pharynx.

Sometimes a substitute for the postnasal syringe may be arranged as follows: Take the ordinary syringe-bag filled with the desired solution for irrigation. A soft catheter (generally a No. 6 or No. 12) is well greased and is attached to the bag and introduced in one naris for 4 or 5 inches. In this way the catheter will reach the naso-pharynx. The fluid is allowed to escape gently and will appear at the anterior nasal orifice, provided the head is well bent forward. After one side has been irrigated the catheter may be pulled out and introduced into the opposite naris.

It is claimed for this method that the irrigation is as thorough as by other methods, and that there is less danger of the fluid entering the accessory nasal sinuses and Eustachian tubes.

Application by Means of Spray.

Application by means of the spray is an easy method of medicating the nose, pharynx, and larynx. The ordinary form of atomizer cannot be termed an entire success, since all the forms with which I am familiar get out of

order very easily. The small covered tube becomes clogged and in a short time the usefulness of the spray is ended. The better sort to use in the nose is one throwing a coarse stream. Into the atomizer bottle may be introduced any solution which the physician may direct. The nose is sprayed simply by introducing the end of the spray into the naris, compressing the bulb a number of times until a stream is started, and continuing this for a period of fifteen or thirty seconds. It may then be removed and introduced into the opposite side.

The pharynx is sprayed by using a straight spray tube; the tongue is depressed by a spoon or tongue depressor. The process of spraying the pharynx should not occupy a longer time than that of the nose.

In spraying the larynx it is necessary to use the atomizer with the tip directed downward. This is known as the larynx tip. It is more difficult to accomplish the spraying of the larynx than of other parts:—

1. Because it is farther away from the spray.

2. Because the entrance is blocked by the tongue and epiglottis.

3. Because the patient is apt to tolerate the spraying of the larynx less readily than other parts.

When the larynx is ordered sprayed, the spray tube must be introduced while the patient, placing a napkin over the end of the tongue, draws the tongue forward by means of the thumb and first finger. When the end of the nozzle is about $\frac{1}{4}$ inch from the posterior pharyngeal wall and is directed downward, it is in such a position that a finely atomized fluid will enter the larynx, particularly if at the time of pressing the bulb the patient inhales.

In the hands of a novice this method of spraying the

larynx is apt to fail. However, after much training a patient becomes very expert, and is able himself to use the laryngeal spray with success. It is generally better to discard the laryngeal tip and use some tip for spraying the larynx which is recommended for use in the nose and pharynx. This does not directly enter the larynx, but the atomized liquid fills the pharynx, and, if the patient inhales very deeply several times, a part of the atomized fluid will enter the larynx.

It can be said of all forms of sprays that they are generally unsatisfactory unless used by the physician.

Internal Local Application.

Local applications are made to the region of the nose by means of a camel's hair brush or a piece of cotton wound on an applicator.

The best method of applying salve to the interior of the nose is by wrapping a match or small stick or a metal applicator with a wad of absorbent cotton and then dipping this improvised brush into the salve until it is covered with a thick layer of salve. This is introduced into one nostril, both of which are grasped with fingers so as to compress the nasal wings upon the cotton. The match is drawn forward, bringing the cotton with it, but leaving the salve. The ointment is easily sniffed backward into the more posterior regions and into the naso-pharynx.

The pharynx is treated with local applications applied by means of a swab. It is generally larger than the nasal applicator, with cotton wound into a rather large brushlike end. This is dipped into a medicament, which is swabbed directly over the pharynx after the tongue is depressed.

To introduce the applicator into the posterior pharynx,

it is necessary that it should be bent forward at an angle of nearly 90 degrees; this end may be carried into the naso-pharynx behind the uvula and soft palate and an application made directly to the pharyngeal vault.

Local applications to the larynx are made by means of the laryngeal brush or the laryngeal applicator. If the applicator contains an arrangement by which the cotton may be wound so that it cannot loosen in the larynx, it is a perfectly safe instrument. But if the ordinary laryngeal applicator is used, it is necessary that the cotton should be more firmly twisted on the end of the applicator. It is dangerous to use in the interior of the larynx an applicator covered with cotton where the cotton is not firmly secured, because the moment the cotton is received between the borders of the vocal cords they close violently on the object and may free it from the applicator. The cotton is then inspired and is often the cause of septic pneumonia and abscess of the lung. If the loosened cotton is not inspired it may remain in the larynx and cause considerable trouble from irritation or it may cause suffocation.

In order to properly wind the cotton, the fibers should all be long, should lie parallel, and the layer of cotton should be rather thin. This thin layer of cotton with parallel fibers is then received on the roughened end of the applicator which has been moistened in a watery solution. When the end of the applicator has been wet, it provides a very firm attachment for the fibers of cotton which lie next to the applicator, and they will be fastened so firmly that they cannot be dislodged or removed. The cotton must be wound so as to cover about 1 inch of the end of the applicator. If wound too near the end of the applicator it may loosen.

Powders.

Powders of various kinds are sometimes used in the nose, pharynx, and larynx, when they are applied by means of the ordinary powder blower.

It is not necessary to describe these blowers. The powder is either received into a small cylinder which is a part of the powder blower and is used when small quantities of powder are required, or the powder is placed in a reservoir, which is generally a bottle. When introduced into the nose or pharynx care must be taken to instruct the patient to exhale rather than to inhale; otherwise the powder will enter the larynx and produce severe coughing and consequent irritation.

Vapor or Steam Inhalations.

The use of heated moisture as a method of conveying medicaments into the respiratory tract was formerly used much more than now, but is still useful in certain classes of cases, particularly for croup in children, and also in some cases of laryngitis. The ordinary method of using steam inhalations is to fill a vessel, having a properly arranged mouthpiece for inhalation, with boiling hot water and introduce into this boiling water a certain quantity of an ordered medicament. The steam arising from the water carries with it a small quantity of medication and the steam is inhaled by the patient as long as necessary. The ordinary inhalers sold in drug stores are known as Maw or the benzoinal inhaler. The latter has the advantage of simplicity, economy, and durability, and can be placed directly upon a gas stove. The Maw cools so quickly that it is practically of no use, and the inhalation tube is so short that the inhaler cannot be used on a gas stove.

An improvised inhaler may be made at any time by taking an ordinary porcelain pitcher, fitting over the top a cornucopia made of rather stiff oiled paper, the large end of which may be introduced into the open end of the pitcher and the small end into the mouth. Hot water and medication are added and inhaled for from three to five minutes.

Different medicaments are used for inhalations, generally volatile oils or ethereal tinctures.

Steam atomizers have been in use, but are not much used at present; although they work better than inhalers, they are expensive and easily get out of order. They are apt to make the throat more tender and thus necessitate the patient's remaining in the house after their use.

The boiler form of steam atomizer is the most convenient form to use for the purpose. It consists of a small boiler placed over a spirit lamp, discharging steam from a spray tube at one end, while the other end of the spray tube is placed in the medicament desired. The atomized steam by suction carries the medicament through the spray tube and atomizes it at one end, throwing it forward to the breathing receptacle and into the patient's mouth.

Essential oils, turpentines, and various antiseptics, soluble in water may be used in this form of inhaler.

Burning inhalations are principally used in affections of the lungs and especially in asthmatic conditions. They are inhaled by the patient under a shawl; the powder, having been touched with a match, burns slowly, emitting a medicated smoke. The best of all inhaling powders is nitrate of potash, to which is added the medicament according to the requirements of the case. Favorite remedies are black tea, camphor, benzoin, sandal, hyoscyamus, and lobelia.

Inhalation by means of the oily spray nebulizer is by

far the best way of introducing medication in an atomized form into the bronchial tubes, larynx, or nose. Inhalations by means of the oily spray are made the same as those described under the head of "Sprays."

Gargles.

Gargles are an antique method of medicating the throat, and as used today they are found to be of practically no value whatever, except as washes for the mouth or the anterior surface of the tonsils, the fauces, and the soft palate.

Experiments have been made on patients who have been ordered to gargle various solutions colored with aniline dyes, which have the property of staining the interior of the throat. After gargling examination was made and the parts reached by the gargle and discolored by the aniline dyes were the base of the tongue, the soft palate, the anterior surface of the tonsil and the anterior pillar of the fauces. It can be seen, then, that these are useless for cleansing the pharynx, and are in every way inferior to the method described under "Douching of the Pharynx."

Gargles are useless in adults and impossible in children, while irrigation of the pharynx is easily accomplished in the most timid children. When the gargle is ordered, it is almost always used diluted with water. The patient should throw the head well back, fill the mouth with the solution, without making the usual vigorous attempts to circulate the liquid in the mouth. The medicament should be allowed to run slowly back as far as it will into the pharynx. After holding the solution in this manner for a few seconds, it is discharged by spitting. The mouth is refilled, and the process repeated until the ordinary quantity of gargle has been used. It is generally necessary that at

least a half-cupful (4 ounces) of water should be used each time the gargle is ordered.

Lozenges.

Lozenges are not much used for the treatment of throat conditions, but occasionally are ordered for the purpose of moistening the throat. They produce secretion of mucus and saliva. There are various lozenges recommended for this; the list is a long one. The method of use is the same for all: the lozenge is held upon the tongue, or tucked between the tongue and the teeth, where it slowly dissolves, and, if it contains any medication, this is slowly swallowed with the saliva, in the hope that it may be of some therapeutic value.

Lozenges are a comfortable accessory to the treatment of throat conditions, particularly in singers and speakers who are troubled with a dryness of the throat.

Vaccines.

The use of bacterial vaccines is common in the treatment of nose and throat infections. The method of administration is like any hypodermic medication. The dose of vaccine is specified by the attending physician. The nurse must be on the alert for symptoms of "reaction," fever, chilliness, rigor, headache, malaise, pains in extremities, sometimes nausea or vomiting. Reaction should result from the use of vaccines, but should usually not be prolonged more than twelve hours. For other details see page 117, Eye Section.

CHAPTER VI.

NURSING METHODS IN PARTICULAR CASES.

Diseases of the Nose.

External diseases of the nose, such as acne, furuncle, verruca, sebaceous cysts, nevus, syphilitic ulcerations, lupus, and rhinoscleroma, deserve but little mention at our hands, for there is little connected with them that pertains to the duties of a nurse other than the application of ointments or medicinal preparations and surgical measures which require no special training of the nurse. In the destruction of nevus, however, it may be mentioned that, when electricity has been used, sometimes an unpleasant cellulitis or reaction will follow the use of the electric needle, whether for chemical disintegration or as a caustic. Under such circumstances the nurse should make applications to the inflamed area as soon as this is noticed. The advent of cellulitis is shown by the presence of slight fever, redness, and swelling. Ice may be applied at once, or, what is still better, cold applications of a saturated solution of aceto-tartrate of aluminum. The lotio plumbi et opii is also a favorite application in these cases.

Fracture of the nose, whether done artificially for cosmetic operation on the nose or as a result of traumatism, may be treated by the nurse in the same way. It is further the duty of the nurse to observe the position of the bandages, to see if all dressings are in place, and that the splints which are used for the support of the septum have retained their original position. It is the tendency of all nasal splints when applied externally to move downward on the face.

They seem to be drawn down by the muscular movements of the face. In case of dislocation of the bandage producing any deformity in the freshly broken nose, the parts should be gently pressed into place again and the splints applied temporarily until the surgeon arrives.

Internal Diseases of the Nose.

ACUTE RHINITIS.

In acute rhinitis or cold there is not much for a nurse to do, and few people who take cold have a nurse to attend them. However, a nurse's duty in such cases is to maintain an even temperature of the room, between 72° and 76° F., to keep the patient in bed and to use massage. The diet should be of a liquid character until otherwise ordered, and the medicine should be given with great regularity. It is rarely necessary in most people to treat the early stages of a cold actively, but, with public speakers, singers, and actors, it is highly important that a cold should be checked at the earliest possible moment. It is in these cases that a nurse may be required to aid in a rapid convalescence.

DIPHTHERIA.

Perhaps there is no other disease in the catalogue of nose and throat diseases in which the duties of a nurse are so exacting, persistent, and important as are those which we are now to discuss. Not only do her duties relate to her patient, but they extend also to herself, and to the protection of others both during the disease and afterward.

Her first duty is, of course, to her patient, and isolation is the first of all. A patient with diphtheria must be isolated, and this must be more than practical; it must be

absolute. The isolation must extend in a certain measure to all the people in the house, and care should be taken to prevent the spreading of the contagion. The expectoration or secretions from the patient must be received in an antiseptic solution. The best for the purpose is a solution of carbolic acid, 1 to 40, or, what is even better, because it has no odor and is more aseptic, a solution of bichloride of mercury, 1 to 1000.

All the receptacles which receive the expectoration or secretions from diphtheria patients must contain a quantity of one of these antiseptic solutions, and the outside parts of such receptacle must also be moistened with the antiseptic solution, since this part as well as the reservoir part may become germ infected.

Pieces of old linen or antiseptic gauze are to be given to the patient instead of handkerchiefs or towels, and these should be immediately burned after using.

Such bedding and clothing as are apt to be soiled by expectoration or secretion containing diphtheria germs must be placed in a carbolic solution of 1 to 40 and afterward boiled, or put in a solution of sulphate of zinc, 1 drachm to a quart, previous to boiling. It is a good rule for all bedding and clothing which have been used about a patient to be dampened with this antiseptic solution before they are taken from the sickroom.

The eating utensils which have been used in the sickroom must be put in an antiseptic solution and cleaned before they are returned to the kitchen. The best solution is a zinc salt solution, particularly sulphate of zinc, 1 drachm to a quart; after being dipped in this solution the utensils should be boiled. After washing they must be boiled again before they are used.

The nurse should have ready at each of the visits of the

physician, a gown which will be sufficient to cover the visitor from his collar to his feet, and which may be used by him during the visit in the sickroom. This seems to be an unnecessary detail in some mild cases, and yet there is always the possibility that a shred of membrane may remain in his clothing where it has lodged when the patient expectorates or gags and may act as a carrier of infection to the next case he visits. Besides this, after visiting a diphtheritic case the physician should disinfect his hands and face, washing them with soap and water and afterward with a bichloride solution 1 to 1000 for the face and 1 to 500 for the hands.

In order to protect the physician from personal contagion and the development of diphtheria in his own person, it is always necessary for him to wash out his mouth and gargle his throat with a weak solution (1 to 5000) of the above, or, if this is not desirable, with some sterile saline solution.

In case the nose or throat of the nurse becomes infected by expectorated membrane while caring for a patient, that part where the infected material has touched should be cauterized at once with any caustic which may be on hand, and afterward the mucous membrane should be washed very thoroughly by means of a douche.

Every precaution should be taken to protect both the physician and the nurse from an attack. The nurse should also protect herself against the dangers which lie in the constant dropping of discharge from the nose and mouth of the patient on the bedclothes and nightdress.

The hands of the nurse must be frequently washed with a disinfectant, consisting of bichloride, 1 to 1000, or carbolic acid, 1 to 80. For this purpose a large bowl of this solution should be kept in the sickroom, where the

nurse can bathe her hands often. In addition to disinfecting her hands the nurse should cleanse her mucous membranes by washing them either with a solution made by dissolving a Seiler tablet in a glass of water or by spraying the nose and throat with a Dobell solution. After this has been done the mucous membranes may be thoroughly washed with a sterilized saline solution.

The nurse, in addition to these precautions, must also receive from the physician, before taking care of a case of diphtheria, an injection of antitoxin, in order to immunize her. This injection should be given before the nurse enters upon her duties. Five thousand units of antitoxin are generally enough.

The nurse's duty in diphtheria includes also the protection of other individuals in the household besides her patient; and it becomes a part of her duty to see that care is taken that no spread of the diphtheria results from carelessness on her part by allowing the friends to come in contact with the patient. It may not be generally known to the nurse, but it is a well-established fact, that, even when cases of diphtheria are apparently well, there is still danger of their infecting other individuals.

To establish this fact cultures from the throat have been made in nearly two thousand cases of diphtheria which had entirely convalesced so that there was no evidence of diphtheritic membrane, and yet in a large proportion the presence of the diphtheritic bacillus was demonstrated in the mouth and nose of these patients after they were apparently well. In most cases the diphtheritic bacillus was found until two weeks after the patient had been entirely rid of the membrane; in some cases it persisted as long as four weeks; at the longest, ninety-one days.

After a case is well enough to be removed to another

room, the nurse may be requested to properly disinfect the sickroom. In cities this is generally looked after by the Board of Health, but in the country this duty sometimes falls to the nurse.

The room in which the patient has been confined must be thoroughly cleaned. The walls must be scrubbed down with wet fresh bread, cut in pieces large enough to hold in the hand, and the entire wall rubbed downward until every inch of surface of paper or paint has been gone over with this damp bread. It is surprising what a quantity of dust and other material will be removed by this method and with it comes any of the germs which may have lodged on the paper or walls. If the walls are painted they may be washed with soap and water. Carpets and upholstery must be removed from the room and subjected to a cleaning by steam. After the carpets have been taken up the floors must be scrubbed thoroughly with soap and water, having first been sprinkled with a bichloride solution of 1 to 1000. The clothing and all linen and white cloth which has come in contact with the patient must be boiled, while books and toys must be destroyed. It is always wisest to destroy books and toys, particularly as the toys may have come in direct contact with the mouth of the patient and may be a very virulent agent in spreading the disease. Books, if valuable, however, need not be destroyed, but may be disinfected by means of formaline gas.

It further becomes the nurse's duty to report to the attending physician any invasion of the quarantine by outsiders. It is better that the nurse should frankly notify the attending physician in case the quarantine rules are broken, so that the physician may give to the person who has broken through quarantine an immunizing injection of antitoxin. Five thousand units are generally sufficient.

In the treatment of diphtheritic cases it is a duty of the nurse to see that the rooms are properly ventilated and lighted. The air of the room should be constantly changed and the temperature should not be allowed to get below 66° or higher than 72° unless specially ordered by the physician. During the sunny portion of the day the shades should be raised and the sunlight allowed to stream into the room as long as possible; nothing is so potent a destroyer of contagion as sunlight.

In all cases, unless otherwise ordered, from the inception of the disease the patient should be kept on a liquid diet; nourishment should be given every three hours. The patient must neither get out of bed or make any exertion, nor must he attend the toilet. This rule is imperative not only during the course of the diphtheria, but must be more particularly and carefully enforced after convalescence has been established, for it is at this time that diphtheritic cases exhibit sudden attacks of heart paralysis, and sometimes during convalescence fall over dead from exertion.

Many physicians use the croup kettle in diphtheritic cases. It moistens the atmosphere in the room, and increases the water on the respiratory mucous membrane. It is used both night and day, and at certain regular intervals is placed over the bed in which the patient is lying. The steam from the croup kettle is sometimes medicated. If this is desired various essential oils, turpentines, and other remedies are used: carbolic acid, turpentine, benzoin, oil of pine needles, creosote, and lime-water are added to the boiling water. The croup kettle, however, must be used only by the direction of the attending physician. In an emergency, a very satisfactory croup kettle may be constructed from an ordinary tin teakettle placed on a gas stove. The spout of this kettle may be elongated by the

addition of a bit of tubing or metal pipe This kettle is to be placed at a convenient distance from the patient where the heat will not be too great, and the steam is delivered from the elongated spout, the end of which should be fixed near the patient's head.

Local Treatment of Diphtheria.

In the local treatment of diphtheria the duties of the nurse are more or less limited. She will probably be ordered to cleanse the infected area of the membranous *débris,* and for this purpose the physician will order a hot normal saline solution, which is about a 0.8 per cent. solution, or, in round quantities, 1 drachm of salt to the pint of water. Sometimes a boracic acid solution is substituted for this, or peroxide of hydrogen may be used as a spray or a wash. If peroxide of hydrogen is ordered, it should not be used stronger than 10 per cent. and seldom stronger than a 1 per cent. solution. It is necessary for the nurse to notice whether the use of peroxide of hydrogen produces pain, and, if it does, to discontinue the remedy. A poultice of flaxseed or a hot-water bag is ordered by some physicians, and cold by means of the ice-cap or icebag by others.

General Treatment.—The general treatment of diphtheria consists in the regular administration of the medicines and the use of calomel fumigations. These fumigations are the favorite method of treatment in the hands of some specialists, and seem to be particularly useful in the cases of young children.

Calomel Fumigation.—The patient is laid upon blankets on a table, to the sides of which have been nailed some half-hoops in such a way as to form a series of arches over the patient. These should arch a couple of feet above the top of the table. A cloth is laid over the arches in such a

way as completely to close the space over the table on the sides, top, and ends, except at one end of the table, where the cover extends some distance from the end of the table, so as to leave a space between the foot of the table and the end of the covering. Under this is placed an alcohol lamp, and over this lamp a platter or metal pan upon which 15 grains of calomel are to be sublimed. The alcohol lamp is lighted to heat the calomel and the vapors rise from the free end of the arch, and are inhaled by the patient who is beneath. This fumigation should be carried on for fifteen minutes. The length of time is always about fifteen minutes, but the frequency varies with the date of the disease. It is a convenient rule to say that 15 grains should be sublimed every two hours on the first and second days, every three hours on the third day, every four hours on the fourth day, and after that only three times each day.

Intubation.—In cases where intubation is required, the duties of the nurse are very important. During intubation it will be her duty to hold the patient quietly during the operation, but her duties afterward are even more important. To prepare a patient for intubation, the child should be completely wrapped with a sheet from the neck to the legs, and the sheet should be tightly pinned behind, while the arms and legs are straight, so there can be no voluntary movements of the hands or legs to interfere with the operation. Care must be taken in pinning the sheet behind not to make it so tight that the patient who has difficulty in breathing will be in any way hampered for breath by unusual constriction of the chest. The nurse should then sit with the patient in her lap, the limbs of the nurse being spread apart and the legs of the child received between her knees, while the legs of the nurse are crossed in front of the legs of the patient so as to hold the patient's legs firmly

from kicking forward or jerking upward. The shoulders and head are held by the nurse by placing the palm of each hand firmly on the side of each ear and allowing the elbows to drop over the shoulders of the patient. In this position the nurse has absolute control over the feet, shoulders, and head of the child, while the hands are firmly confined in the pinned sheet, and any movement which would interfere with the operation is prevented. The child's head should be held absolutely horizontal.

During the operation the nurse has no other duties than that of holding the child immovable; but after the operation it becomes her important duty to watch the string to which the intubation tube is attached, if this be not cut and removed, to watch the breathing of the child, to see that the tube is kept clear from mucus, and to attend to the feeding of the patient at regular intervals.

After it has been ascertained that the tube is in the larynx, and the difficulty of breathing has been relieved, it is common in this country to cut the string which is attached to the tube and withdraw it. Abroad it is sometimes customary to allow the string to remain in place. Then it is drawn through the mouth alongside of the cheek and is loosely tied around the ear. As the string is very much in the way, there is a constant danger that the child may dislodge the intubation tube by pulling the string.

The only purpose which a string can serve after the tube is in the larynx is for the quick recovery of the tube in case it should be expelled. If the string is removed, it becomes the nurse's duty to carefully watch for the tube, and if there are any indications that the tube has become dislodged the patient must at once be turned head downward and the fingers introduced in the pharynx to grasp the loosened tube before it can be swallowed.

Another duty of the nurse after an operation is to see that the tube is free from mucus. The patient generally attends to this fairly well, for, when the tube is clogged with mucus, the patient attempts by violent expiration to dislodge it. If he does not succeed and there seems to be some permanent obstruction of soft tissue or mucus in the tube, the nurse should allow the patient to swallow a small quantity of water, when the mucus or shreds of necrotic tissue will be expelled by violent coughing. It rarely becomes necessary for the nurse to remove the tube. If, however, the patient becomes cyanosed from an obstruction of the tube which seems to be permanent, and it becomes imperative that the tube should be taken out, it may be removed by the nurse by pressure on the trachea below the level of the tube, stripping the trachea and larynx from below upward, while the patient is placed with the head downward. In this way it will become possible oftentimes to remove the intubation tube if it is desired to do so in an emergency.

The feeding of infants who are wearing intubation tubes is accomplished by placing the patient on the back or side with the head lower than the feet, all the swallowing to take place while he is in this position. In this way it becomes possible for intubation patients to take quantities of nourishment without any entering the larynx through the intubation tube, while, if the patient is fed in a sitting position, it becomes almost impossible to take any kind of nourishment because of food entering the trachea through the tube.

When it becomes necessary to remove the tube from a young child, it is always wise for the nurse to prepare the patient as previously described for the introduction of the tube; and after the tube has been removed to keep down

the tendency to swelling and edema by means of the application of an icebag to the throat.

Antitoxin.—When antitoxin is to be used, the nurse must prepare the skin between the shoulders and under one

Fig. 32.—Stripping the Trachea and Larynx to Remove Clots of Blood or the Intubation Tube.

shoulder blade by washing it with soap and water generally. It should be washed afterward with a carbolic solution or rubbed with alcohol; and thus the skin is rendered fit for the introduction of the antitoxin hypodermic needle. The

absorption of the antitoxin is accelerated by gentle massage of the part. A bit of plaster may be placed over the puncture to prevent infection. Unfavorable symptoms from antitoxin are rarely seen, but sometimes an eruption of the skin similar to scarlet fever follows the use of this remedy.

HYPERTROPHIC RHINITIS.

Cases of hypertrophic rhinitis generally require the nurse only during and for a few days after the operation. The nurse's duties in these cases are of such a general nature as have already been described while discussing local applications, cocainization, douches, preparations of the patient, cauterization, care of instruments, etc.

Sometimes the physician in the office treatment of these cases uses a galvanocautery instead of using medicinal cauterizants. In case medicinal cauterizants are used, it may be well for the nurse to be familiar with their method of application. Generally either chromic acid, monochloracetic acid, or silver ntirate is used. All of these are best applied by means of heating a metal applicator and dipping it in the remedy to be used, so that a small globule of the melted material will adhere to the withdrawn probe. By gently heating this over the flame it can be made to run down to the very end of the probe, forming, when cool, a solid little ball, which may be used in this form.

OPERATIONS ON THE ACCESSORY NASAL SINUSES.

In diseases of the antrum of Highmore nearly all that has been said about the conduction of cases along ordinary lines of surgical procedure, irrigations, and the use of powders applies to these cases. The ice-cap or cold or iced cloths applied to the cheek or eye are useful to keep down

swelling, ecchymosis, or pain after these operations. In frontal sinus cases all that has been previously said about general surgical procedure, douching, and irrigation will also apply to the cases. But particular attention must be paid in case the skin incision has been closed that the irrigation of the frontal sinus is not carried on in such a way as to produce pressure on the sutures. After operations upon the ethmoidal cells the nurse's duties include the employment of external applications and irrigation; but in these cases the nurse must watch the eye and the lid for evidences of congestion, inflammation, or ecchymosis.

Quite frequently from sixteen to twenty-four hours after these cells have been opened, there will be some ecchymosis of the upper lid. This may not be of any importance, but as soon as it appears iced cloths should be applied to the eye and to the nasal region. Emphysema of the upper eyelid in these ethmoidal cases indicates perforation of the orbital plate. Iced cloths are the proper remedies.

Tonsil Operation.

After the tonsil operation the nurse's duties are of the highest importance. She may detect the beginning of a hemorrhage which, if prolonged, may be serious and she may add greatly to the comfort of adult patients, who, to say the least, are usually decidedly uncomfortable after the operation.

If the operation has been performed under local anesthesia these duties are simplified into watching for an easily detected hemorrhage manifested by the conscious patient expectorating bright red blood, but when the operation has been performed under general anesthesia and the patient remains unconscious for an extended period an ex-

tensive, even dangerous, hemorrhage may occur unless the nurse is alert to detect it.

All unconscious patients after the tonsil as well as after the adenoid operation should always be kept on the abdomen or the side with the head low. In this position if bleeding occurs the blood will flow from the mouth or nose and will be detected at once. In any other position the blood will trickle down the throat, will be swallowed and this hemorrhage may go on undetected until the patient is exsanguinated and exhausted.

Suddenly such a patient will show a very rapid and feeble pulse, this will be followed by the vomiting of a large quantity of blackish discolored blood. If further neglected the patient will continue to bleed and death may result. How important then is it for the nurse to keep her patient on the abdomen or side with head low rather than to run such a risk! Semi-unconscious cases partially recovered from their anesthesia are not easy to keep in this position, and try the patience of any nurse. But we all know that good nurses are endowed with exhaustless patience and are ready to replace again and again the restless and unreasonable client. I know of no other method of detecting bleeding with the patient on the back except to watch the case for regular swallowing. This indicates that blood is being swallowed but it is not safe to rely upon it.

The vomiting of a quantity of dark blood *once* is not a symptom of any importance unless the pulse becomes rapid and feeble afterward. The repeated vomiting of dark blood in which some bright red streaks may be discerned *is* a symptom of great importance and warrants notification of the surgeon *at once.*

After recovery from the anesthesia the danger of hemorrhage is practically ended and children, especially,

have very little pain or discomfort. Adults, however, suffer more pain and discomfort than children and may require the application of icebags to the outside of the neck and sometimes we allow them to suck pieces of ice. As a rule, however, it is better to keep the patient from swallowing. One should also not use any spray or gargle for the first forty-eight hours but should be satisfied to apply icebags if necessary and limit the swallowing to liquid food or ice cream in small quantities infrequently repeated. In adults, sometimes, a dose of morphine sulphate, 1/6 grain, is advisable the first night.

After two days the physician may order a spray of argyrol 10 to 20 per cent. used each four hours. The throat should not be sprayed before this, nor should any attempt be made to dislodge or remove the white membrane which in all cases covers the operated field after the first twelve hours.

Adults infrequently complain of great discomfort from swallowing even later than forty-eight hours after the operation. In such cases it is advisable to use an anodyne powder and they experience great relief if the throat is covered each three hours with a powder blown upon the operated parts by a powder blower. Such an anesthetic powder is compounded of equal parts of orthoform, acetanilide, and gum acacia.

Gargles, solid food, talking, all increase the muscular movements in the throat, therefore increase pain. They are inadvisable. The patients until all difficulty with swallowing disappears, should limit their efforts to swallowing liquid or semi-solid foods: milk, eggs, cocoa, ice cream, oysters, soft, well cooked cereals, milk toast, custard. After twenty-four hours adults may be allowed out of bed and next day may be allowed to go out of doors.

PERITONSILLITIS (QUINSY SORE THROAT).

The nurse may be required to irrigate through the incision which has been made into the pillar of the fauces. The small nozzle is atached to the syringe or fountain bag, containing a proper antiseptic solution, and introduced into the wound, the patient's head being bent forward. The irrigation is performed under low pressure.

EDEMA OF THE LARYNX.

In cases of edema of the larynx it is necessary for the nurse to apply ice to the neck and to give the patient ice in small pieces to suck. Careful attention must also be paid to the degree of difficulty in breathing, and upon the slightest increase of this difficulty the physician must be notified at once. Sometimes it is possible for a nurse to save the life of a patient by using a good-sized soft rubber catheter as an intubation tube. It is passed over the epiglottis and base of the tongue into the larynx, and beyond the area of the edema. This tube may be left in place indefinitely, but it should be tied to one ear by means of a string.

TUBERCULOSIS OF THE LARYNX.

In cases of tuberculosis of the larynx the greatest danger is the development of edema, in which case the nurse should follow the lines indicated under the head of "Edema of the Larynx." Edema is particularly apt to develop in cases which have been curetted or where the tubercular areas have been excised.

TUMORS OF THE LARYNX.

Cases of tumors of the larynx may require tracheotomy. In such cases all that has been said about the care of

the patient during tracheotomy applies to these cases. If the cases have been operated on from the inside (endolaryngeal) the remarks which have been made concerning edema of the larynx are applicable. If, in order to reach the tumor, the larynx has been split and sutured (fissure of the larynx), the remarks which have been made concerning edema of the larynx and acute inflammation of the larynx are applicable.

In cases where the larynx has been excised the case must be treated along the lines of general surgical procedure, and particular attention must be paid to hemorrhage and the danger of inspiring blood or mucus. (See also page 297.)

OPERATIONS ON THE LARYNX.

I. *Internal Operations on the Larynx.*—After purely internal operations upon the larynx the patient should abstain from using the voice except as a whisper for two or three days. If inhalations of steam are ordered they should be used as mentioned on page 312. The usual treatment is to spray the larynx with an argyrol solution 10 or 20 per cent., about each three hours (see page 309), perhaps to follow this spray with one of an oily character, and to attend most punctiliously to the hygiene of the mouth and teeth.

II. *In External Operations on the Larynx.*—Laryngotomy or Laryngectomy.—The duties of the nurse are very exacting and important in these more important operations. The matter of diet is fully considered on page 276, and following pages. For three days before the operation the patient must have a careful oral and dental cleansing each three hours. The mouth and pharynx are gargled with an antiseptic solution, Dobell's solution perhaps, and the teeth

are brushed and cleaned also each three hours with a good dental paste. Immediately afterwards the mouth and pharynx and teeth are sprayed with a solution of argyrol, 20 per cent., and the teeth crevices are cleaned with an argyrol-soaked pledget of cotton. Surgeons believe that the after-results depend largely on the care given the patient before the operation. A clean mouth prevents sepsis, an unclean mouth invites it.

After the operation the patient is placed in bed with the head and chest lower than the feet and abdomen for twenty-four hours. As soon as possible after the first forty-eight hours the patient should be made to sit up in bed, or even get into a chair. This rather rigorous treatment is supposed to ward off the post-operative pneumonias which frequently complicate these operations. My own belief is that the post-operative pneumonia is septic and cannot be prevented by posture.

Besides this the nurse must be alert in watching the temperature which should always be rectal, and should scrutinize the dressings constantly: a bandage which becomes wet or slimy indicates that the wound is leaking and that the deeper sutures are not holding.

After these operations it is customary to use atropine sulphate, $\frac{1}{150}$ grain, by hypodermic injection, repeated often enough (each three hours), to reduce and control the oral and pharyngeal secretions.

Bronchoscopy and Esophagoscopy.

The instruments for this procedure are all sterilized by boiling except the apparatus which holds the electric light in the Brunig instrument. The electric light and holder are sterilized in alcohol in the Jackson and Brunig instruments. The patient is prepared as for an ether oper-

ation and a preliminary hypodermic injection of morphine sulphate, $\frac{1}{6}$ grain, is given one hour before the work begins. It is well to give a full dose of atropine sulphate ($\frac{1}{100}$ grain), also to control mouth or bronchial secretions.

The patient's head is covered with the usual towel cap described on page 275, and the patient is placed on the back upon the table.

The table used in bronchoscopy and esophagoscopy is about 5 feet high and on the head end has a shelf level with the table, 18 inches long and one-half the width of the table. The head of the patient is bent backward over the end of the table in such a way that the shelf gives firm support for the surgeon's right arm.

The nurse's duties during this operation are especially to count cotton pledgets, and watch the pulse of the patient. After the operation the nurse's duties are the usual ones following any operation.

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